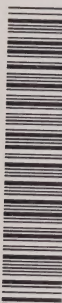


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THE BULLETIN

Vol. VII.

No. 10

Hydro-Electric Power
Commission of Ontario
DECEMBER
1920



Virgin Falls, Nipigon River



THE BULLETIN

PUBLISHED MONTHLY BY THE

**Hydro-Electric Power
Commission of Ontario**

**ADMINISTRATION BUILDING
190 UNIVERSITY AVE.
TORONTO**



**SUBSCRIPTION PRICE:
TWO DOLLARS PER YEAR**

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DECEMBER 1920

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Address by the President, Mr. O. H. Scott

It is indeed very gratifying to see so many here. The attendance is much larger, I think, than it was a year ago. Evidently the power shortage has eased off and you feel you can leave home with a clearer conscience than you could a year ago.

In reviewing the work for the past year I don't think there is anything, at least to my mind, that is quite so important as the report of the Rules and Regulations Committee on the Standardization of Plugs. To my mind that was a very important decision and I have been wondering, how many of the member utilities when they have been doing any purchasing have borne in mind that report? There is certainly not much use of the Association having these committees go to work and bring in a very detailed report, unless the members of the Association make some use of it. I notice that a lot of the manufacturers are still putting on the market appliances which have not the detachable plug with the standard type connections, and I think, now that as seven months have passed since our June convention, the utilities can start in to purchase only those appliances which have the standard plugs.

With reference to the future, there are several things that strike me as being very necessary for the Association at large. We have heard a great deal about co-operation among the various electric fraternities, manufacturers, jobbers, contractors, dealers and so on, but it just strikes me that there is a very great room for greater

co-operation within the utilities themselves. What brought this to my mind was that during the power shortage this fall I noticed, in one part of the Niagara Peninsula, power was apparently taken away from one utility and given to the City of Toronto; in another section another appeared to be discriminated against in favor of somebody else. These things, to my mind, tend to stir up an ill-feeling among the various towns, which we as operating men must stop. Of course they may be more political than otherwise, maybe they didn't originate in the Hydro office, but at the same time it points out the necessity of all the operating engineers and the operating executives getting closer together and co-operating as closely as possible; because after all, your Commissions come and go, the different members change, whereas most of the operating executives are there for a good many years.

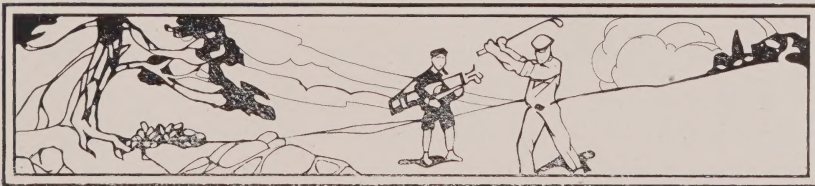
I think the Association can do a great deal in the various things which come before it by bringing more men into the committee work. There are no doubt a great many problems that are bothering various operating men, but the Executive of the Association has not been called upon by any of the utilities to go into these matters.

There is also another matter that strikes me as being of importance, and that is THE BULLETIN. From time to time we have had invitations from the Committee who edit and look after THE BULLETIN to send in articles. In his paper last year Mr. Buchanan suggested we should send in com-

parative statements of the business we are doing. Now this is a great opportunity for the Executives to get some real information, but up to the present I have not noticed it being used in the way it should be. We can do a great deal for THE BULLETIN. We might even have a committee of this Association to work with the Committee who are located in Toronto in getting out THE BULLETIN. I am satisfied there is a fund of information which the operating executives in the different towns have which could be used in other places if they would only send it in.

The program which is before you, as you will notice, says nothing about any paper on the Sales Department or the selling of appliances. The Executive Committee did this for a purpose because at the time they met, previous to the taking over of the Toronto and Niagara Power Company, when the shortage of power was very keen, they did not feel that with

the shortage of power they could discuss the question of the sale of appliances. So that matter was left off, but it seems to me that there again we have a vast field for co-operative effort among the various utilities to get together. By special advertising campaigns carried on throughout the whole Province of Ontario, all the different utilities possibly using the same type of advertising applying to utilities, and using a standard wording for their shop and in a great many various ways, the co-operative effort of all the utilities would, to my mind, practically swamp the utilities in the appliances business. I can't see anything else for it. A man comes from one section of Ontario and is confronted with an electric shop selling appliances in another section of Ontario, with the same name. He has got good service in the other town, and there is no question but that the man will become linked up to that shop also.



Association of Municipal Electrical Utilities of Ontario

AUDITORS' REPORT

RECEIPTS:—

Balance carried forward from January 15, 1920		\$413.31
<i>Received during the year:</i>		
130 dinner tickets, at	\$ 1.50	\$195.00
186 dinner tickets, at	2.00	372.00
36 Commercial Member Fees, at	10.00	360.00
Commercial Members' space		128.00
4 Members Municipal	50.00	200.00
6 Municipal, at	25.00	150.00
1 Municipal, at	35.00	35.00
8 Municipal, at	15.00	120.00
15 Municipal, at	10.00	150.00
18 Municipal, at	7.50	135.00
27 Municipal, at	5.00	135.00
29 Municipal, at	2.00	58.00
Interest on Bank Balances		38.18
		<hr/> 2,076.18

DISBURSEMENTS:

		\$2,489.49
Badge Pins and Badges	\$ 44.22	
Walker House, for January Convention	247.65	
Entertainment	24.00	
Stenographic Report	81.00	
Clifton House, for June Convention	725.00	
Entertainment	71.50	
Stenographic Report	67.05	
Stationery, Printing and Postage	213.90	
Expenses of Executive attending Com. meetings	149.90	
Discount on Cheques	9.60	
Miscellaneous Expenditure	6.32	
Honorarium for Secretary	50.00	
		<hr/> \$1,696.14
Balance on hand, December 31, 1920		\$ 799.35

Mr. S. R. A. CLEMENT,

*Secretary Association of Municipal Electrical Utilities of
Ontario, Toronto.*

We have audited the books and vouchers of the Association to December 31, 1920. Expenditures are supported by properly authorized vouchers, and the balance of \$799.35 carried forward to 1921 has been verified and is in agreement with Bank Account.

Submitted by

W. G. PIERDON, }
H. P. L. HILLMAN, } *Auditors.*

Report of Regulations and Standards Committee

OSHAWA, ONT., January 26, 1921.
Mr. S. R. A. Clement,
Sec. Association of Municipal Elec-
tric Utilities,
190 University Ave., Toronto,
Ontario.

Dear Sir:

Referring to your letter of Novem-
ber 19th, 1920, with attachments, re
Canadian Engineering Standards As-
sociation with reference to formulat-
ing a Canadian National Electric
Code.

Your Regulation and Standards
Committee beg to report that they
wish to co-operate with the above As-
sociation in the adoption of a uniform
code throughout Canada. We are
therefore returning questionnaire filled
in as requested.

Yours truly,

Regulation and Standards Committee.

A. T. HICKS.
(Sgd.) R. H. STAFORD.
H. STRICKLAND.
T. C. JAMES.

CANADIAN ENGINEERING STANDARDS ASSOCIATION

SPECIAL COMMITTEE ON CANADIAN NATIONAL ELECTRIC CODE.

QUESTIONNAIRE.

1. Do you consider it desirable for Canada to have an
electrical safety code of Dominion-wide acceptance, cov-
ering:—
 - (a) Safety from fire risk..... { Yes }
 - (b) Safety as regards life and accident risk to the
public and to operators?..... { Yes }
2. If the Canadian Engineering Standards Association en-
deavors to form a representative committee to deal
with this matter, can we count on your co-operation?..... { Yes }
3. Do you consider that there is reasonable prospect of
Dominion-wide adoption of such a Code?
 - (a) As regards safety from fire risk?..... { Yes }
 - (b) As regards safety from life and accident risk? { Yes }

SIGNED.....

Dated.....

The Testing and Approval of Electrical Appliances in Ontario

By W. P. Dobson

Laboratory Engineer, Hydro-Electric Power Commission of Ontario



IN the elimination of fire and accident hazards from electrical installations two closely related but separate features are involved. One of these has to do with the method of installation and necessitates a visual examination of the completed work to detect hazards due to improper or careless methods. The other feature is supplementary to this and is concerned with the quality and condition of the materials and apparatus employed. It involves careful tests under standard conditions which are not usually obtainable except in a laboratory. This feature of electrical inspection may be designated approval testing as distinct from the first feature or field inspection. Approval testing is the function of the Approval Laboratory of the Commission.

In the early days of the Electrical Inspection Department the work of approval was carried on by that department in conjunction with field inspection. Devices and materials which bore the label of Underwriters' Labo-

ratories of the United States were accepted as satisfactory in any installation. Much material, however, continually appeared on the market, which had not been approved by the Underwriters' Laboratories and such material was examined and approved by the Electrical Inspection Department. Labels were distributed to manufacturers for use with certain types of goods such as service boxes, motor starters and electric signs. The number and variety of devices and materials appearing on the market increased so rapidly that it was found impossible for the Inspection Department to carry on both approval and field inspection, especially in cases when laboratory tests were necessary. Accordingly in 1917 the approval testing was turned over to the Laboratories Department of the Commission and a section was organized to carry on the work under the name of the Approval Laboratory.

SCOPE OF WORK.

The scope of the work is indicated by the wording of the announcement made by the Commission at the time of the organization of the Approval Laboratory. This reads as follows:—

Pursuant to Power Commission Act, 6 Geo. V., Chapter 19, Section 10, 1916, and amendments thereto, and the Rules and Regulations of the

AUTHOR'S NOTE—The paper I have prepared is a short description of the methods employed in the testing and approval of electrical appliances in Ontario in conformity with the Electrical Inspection Act in force insofar as it relates to electrical devices and fittings as distinguished from the field inspection and installation inspection.

Hydro-Electric Power Commission, covering the design and construction of electrical machinery, apparatus, appliances, devices, material and equipment, for use in the generation, transmission, distribution or use of electrical power or energy in the Province of Ontario, in connection with any electrical installation or wiring for electric light, heat or power, where the electric pressure delivered to or from the same exceeds 10 volts, manufacturers of, jobbers, agents and dealers in electrical machinery, apparatus, appliances, devices, material and equipment, and others interested are hereby notified that the Commission orders that, on and after three months from date of this notice no such electrical machinery, apparatus, appliances, devices, material or equipment used or to be used, as above, may be used, offered for sale or disposed of in the Province of Ontario unless and until the design and construction of same has been submitted to the Hydro-Electric Power Commission of Ontario and approval of such has formally been obtained.

(This notice was published in Ontario on the 17th day of January, 1918).

While any device designed to operate on a circuit of over 10 volts comes within the jurisdiction of the Approval Laboratory, the work of approval testing has been confined chiefly to devices rated at 600 volts or less; special attention being given to those classes of appliances which are sold to the public for unrestricted use.

The following incomplete list will indicate the diversity of devices and

materials which have been submitted for approval and tested in the Laboratory.

Wires for electric ranges, Ground clamps, Conduit and conduit fittings, Enclosed motor starting switches, Switch boxes, Electric Signs, Cabinets and cutout boxes, Panelboards, High frequency Generators, Electrically operated pumps, Rectifiers, Sockets, Receptacles, Lamp Shades, Lamp fixtures and fittings, Wire connectors, Air heaters, Pressing irons, Automobile Heaters, Cooking and liquid appliances, such as ranges, hot plates, water heaters, toasters, grills, Elevator switches, Farm Lighting Plants, Oil-break switches, Fuses—plug and cartridge, renewable and non-renewable, Current taps, Cutout bases, Rosettes, Bell-ringing transformers, Electrical soldering tools, Soldering lugs, Insulating devices, Outlet bushings and fittings, Auto-starters, Washing machines, Oil and gasoline pumping outfits, Elevator controllers.

METHOD OF PROCEDURE.

It is incumbent upon the manufacturer to obtain approval of the design and construction of his product before offering it for sale in Ontario. To obtain this approval, the device in question is sent to the Laboratories accompanied by a formal application to the Commission. The necessary tests are then carried out and the manufacturer advised of the changes, if any, which are necessary to bring the device up to standard. It is sometimes necessary to submit two or more samples before one is produced which is in accord with the requirements. When a device has finally been con-

structed which is considered by the Laboratory to be free from fire and accident hazard, a report is prepared describing in detail the construction of the device, the tests which were made upon it and a recommendation that it be approved.

APPROVALS COMMITTEE.

This report is submitted to each member of a Committee composed of representatives of the Hydro-Electric Power Commission, the electrical manufacturers, dealers, jobbers and professional societies, and the Fire Underwriters.

The personnel of this Committee is as follows:—

W. P. Dobson, Chairman; A. S. L. Barnes, Secretary; W. C. Cale, Approval Laboratory; Wills MacLachlan, L. G. Ireland, R. T. Jeffery, E. M. Wood, J. F. S. Madden, Hydro-Electric Power Commission; A. G. Hall, Electrical Inspection Department, Hydro-Electric Power Commission; J. A. McKay, representing Canadian Association of Manufacturers of Electrical Supplies; C. E. Schwenger, representing Association of Municipal Electrical Utilities of Ontario; O. V. Anderson, representing Canadian Electrical Association; S. A. Gaskell, representing Canadian Association of British Manufacturers; C. H. Carlisle, representing Canadian Manufacturers' Association; Joseph Rogers, representing Can. Electrical Supply Jobbers Association; K. A. McIntyre, representing Ontario Association of Electrical Dealers and Contractors; F. R. Ewart, Representing Toronto Section, American Institute of Electrical Engineers; William Taylor, representing Associated Boards of

Trade of Ontario; R. Driscoll, representing Canadian Fire Underwriters' Association.

Each member of this committee is asked to read the laboratory reports and signify his approval or disapproval. When agreement among the members of the committee has been reached the report is presented to the Commission with the recommendation that the device in question be approved for use in Ontario.

When the recommendation has been sanctioned by the Commission the manufacturer is so advised and an "approval number" is issued which serves to identify the particular device or line of devices approved. A card index of approved devices is distributed to the district inspectors of the Commission, and to others interested. This forms a continuous record for the use of the inspectors and contains sufficient information to enable them to identify any approved device which may be brought to their notice.

RE-EXAMINATION.

When a device has been approved, the manufacturer enters into an agreement with the Commission to manufacture all future devices in exact duplicate of the sample approved. The Commission agrees to allow its name to be placed upon the device together with the approval number mentioned above, thus signifying that it has passed the necessary tests. This is usually accomplished by placing on the name plate the abbreviation "H.E.P.C. App. No.———" On certain devices such as enclosed switches, cabinets, conduit, fuses, etc., labels are used. These are furnished by the Commission and are affixed by the manufacturer.

In order to keep a check on the quality of the product of any factory, periodic tests are made in the laboratory on samples selected in the factory or purchased in the open market. A representative of the laboratory also visits the manufacturers to examine their product and render them assistance in any matter relating to approval.

By this means it is possible to keep a continuous check upon the various classes of electrical devices and to detect cases of hazardous construction.

Although the majority of the manufacturers making use of the laboratory are located in Ontario, its services have been made use of by other Canadian manufacturers and by a considerable number of American manufacturers, whose goods have not been submitted for approval to Underwriters' Laboratories. Many of these manufacturers, however, have obtained the Underwriters' approval and in such cases their goods are listed in the records of the Commission upon payment of the cost of listing, provided they also conform to the requirements of the Inspection Department. It is necessary, however, that all such goods be so listed before being distributed in Ontario.

STANDARDS.

All tests on devices and materials submitted are made with reference to standards where such exist. These are specifications of the various features of construction considered necessary to minimize fire and accident hazard, and of the tests necessary to determine how the specifications have been complied with. The standards in general use in America

are those based upon the National Electrical Code of the United States prepared by the National Board of Fire Underwriters, in co-operation with electrical manufacturers, inspection authorities and other interested bodies. These follow standards of construction and wiring in use in the United States and generally adopted throughout Canada.

The standards adopted by the Commission at the inception of the work agree in all essential details with those of the Underwriters' Laboratories insofar as they relate to the fire hazard, but conform to the Rules and Regulations of the Commission for inside electrical installations where these differ from the National Electrical Code. These differences deal chiefly with the elimination of danger to persons from shock, a feature of inspection which until recently has not been emphasized by the Underwriters.

The preparation of standards must of necessity lag somewhat behind the progress of manufacture, hence, standards are not yet available covering all classes of devices on the market.

Standards for the following materials and devices have been promulgated by the Commission:—Rubber covered Wire and Cable Armored Cords and Cable, Cartridge Enclosed Fuses, Snap Switches, Cabinets and Cutout Boxes, Electric Signs, Panelboards, Knife Switches, Cutout Bases, Soldering Lugs, Flexible Cords, Ground Clamps.

These standards specify in detail the various features which are considered worthy of attention from the point of view of safe construction,

such as clearance between live parts and ground and between points of opposite polarity, thickness of metal, current density, etc. They also specify dimensions of various devices such as fuses, cutout bases, screw shells, etc. Many devices are submitted for approval however for which no specific standards exist. Consequently the Commission has with the co-operation of the manufacturer and other interested parties, prepared standards for certain classes of materials and devices as such were found necessary. Those prepared to date are: Electric Washing Machines, Enclosed Switches, Electric Ranges.

Much assistance is rendered the Laboratory by the Inspection Department, in reporting cases of substandard construction and in obtaining market samples for laboratory examination. The various organizations represented on the Approvals Committee also co-operate in the criticism of Laboratory reports and, in particular, the Canadian Associated Manufacturers of Electrical Supplies in the work of preparing standards.

The importance of the approval testing work need not be emphasized

before a meeting of the Association of Municipal Electrical Utilities. There are several self-evident facts, however, the full significance of which may not be universally realized even by the electrical fraternity. The approval testing has been referred to as supplementary to field inspection. It is in reality of fundamental importance to the latter, since safe methods of installation are of no avail without properly constructed appliances and materials. The importance of the work to the safety of the public and of property cannot be over emphasized. The fire loss from electrical causes is still large. The danger to life even in low voltage appliances has not been wholly removed. Consequently continued vigilance in the construction of materials and appliances is an essential feature contributing toward safety in the use of electricity. The growth in the use of electricity by the public at large will depend upon safe construction of appliances as much as upon economy and convenience. It is therefore incumbent upon all who are interested in furthering the use of electricity to co-operate in the maintenance of safe standards of construction.

Discussion

January 21, 1921.

The Secretary,
Municipal Electrical Utilities of
Ontario,
c/o Hydro-Electric Power Commission,
Toronto, Ontario.

Re-Electrical Fatalities in Bathrooms
Dear Sir:

I have noted with great interest the editorial comment of the "Electrical

News" in regard to the above in their issue of January 15th, especially the editor's suggestion that these accidents might well form a topic of discussion at your convention and others likewise—a recommendation I am heartily in sympathy with and one which I will endeavor to have acted upon at the convention of the Western Association of Electrical Inspectors

at Detroit at which I hope to be present.

While insurance inspectors may, without censure, overlook the life hazard, electrical inspectors connected with municipal or governmental organizations cannot do so and I think they are deserving of censure if they do not exert the necessary pressure to minimize as far as possible these regrettable fatalities. I have written the editor of the "News" expressing some thoughts that I hope may be of some use and enclose a copy of this in case you care to bring this up for discussion.

I think we should all bear in mind that not every device that is placed upon the market is necessarily safe to put into the hands of women and children knowing, as we do, the danger that may be occasioned. It would appear that manufacturers are not sufficiently alive to the necessity of safeguarding persons from shocks in the use of the various appliances they manufacture and extremely serious hazards have been demonstrated to be present in devices that appear perfectly innocent of such conditions.

ELECTRICAL DEPARTMENT

It would appear to me that there must be a higher standard of insulation demanded and other reasonable degrees of safety called for in the use of various devices such as radiators and other appliances that, of necessity are used in proximity to grounded surfaces and materials.

Yours truly,

(Sgd.) F. A. CAMBRIDGE,
City Electrician.

January 21, 1921.

The Editor, "Electrical News,"
347 Adelaide Street West,
Toronto, Ontario.

Dear Sir:

I have read with much interest your editorial in regard to bathroom fatalities from electrical causes in the issue of the 15th inst. and agree with you that this matter should receive the attention it merits at electrical conventions. Municipal inspectors who are charged with the duty of dealing with the life risk as well as the fire risk have, I think, recognized this problem as being one requiring adequate treatment in the past in so far as the installation of lighting facilities were concerned. For instance, in this city we have, for the last ten or more years, insisted on bathroom lights being placed on the ceiling and controlled by switches, such switches being located out of reach of persons handling plumbing fixtures. But the problem has been intensified by the growing use of all kinds of utility devices, many of which are used in bathrooms.

As an example of the proportion this reaches, I might cite a case recently discovered in this city where a building formerly used for hotel purposes, having bathrooms attached to each suite of rooms, has now been turned into a tenement building. On making a re-inspection, we found a large number of small electric stoves being used in the bathrooms for cooking purposes. In this particular building, the wiring was installed before the present regulations were drafted and the lighting in the bathroom was by a bracket to which the heaters were found connected by means of a

two-way cluster plug. Of course in this case we required the owner to eliminate the bracket and install a receptacle on the ceiling in order to make it more difficult for the tenant to carry on the practice noted.

We are also in this city attempting to deal with the radiator problem in bathrooms by recommending that the radiator be permanently installed with its frame grounded and solidly connected to the wiring outlet. In case this cannot be secured, we call for a three-wire receptacle, with a ground wire connected to one of the binding posts, and a three-wire cord and plug with the third wire connected to the radiator frame. While it might appear that these measures would fairly successfully deal with the radiator problem, there is an ever-increasing use of other devices bought mostly over the counter from a dealer and connected by some means or other to a lighting outlet without any inspection.

I cannot offer any suggestion as to how this can be taken care of except by having the lighting outlets placed upon the ceiling out of reach and making it as difficult to attach a portable as possible.

I would offer another suggestion and that is that the neutral of a 3-wire system or one side of a two-wire system supplying current to buildings for lighting and heating purposes, etc., should be grounded in a thoroughly efficient manner. In this city while we have had a number of fatalities, such as the one related by you, in past years, there has not been one case where even a severe shock has been reported in the districts of

the city that have been protected by the grounding of the Secondaries. The grounding system in this city is of a very thorough character, the light companies being required to connect to the water mains on the street; grounds inside buildings are only allowed as auxiliaries to the made grounds outside, the consequence being that we have extremely low resistance paths to ground. This is a matter I think that is not always given the attention it deserves and I have still to be convinced that A.C. secondary circuits, thoroughly protected in this manner and in which the nominal voltage to ground does not exceed 110 volts, are capable of producing fatal shocks.

Yours truly,

F. A. CAMBRIDGE,

City Electrician.

MR. G. B. MULDAUR, General Agent Underwriters Laboratories, Chicago, Ill.: Mr. Chairman, it is a great pleasure to be here to-day. It is entirely unexpected. Mr. Dobson was good enough to bring me here to listen to his paper which has been exceedingly interesting. He has been good enough to refer to the co-operation of the Underwriters Laboratories with his organization, and I don't know that it is known to most of you, that the Underwriters Laboratories of Chicago while having a good many Canadian clients has never had as many as it might otherwise have had from the very fact that it is a foreign corporation. Quite recently your Government has given us a charter for a Canadian laboratory. The Underwriters Laboratories of Canada is now chartered and now in process

of actual organization for work. We have proceeded to the greatest possible extent with the co-operation we have already had from Canadian individuals, firms and organizations, and we hope and expect to continue to have that co-operation and we honestly believe that the organization of the Canadian laboratories will serve a very useful purpose both to the old organizations and to the departments and clients which we have already and hope to increase here.

This opportunity is too good a one for me to lose to say just a word or two to you in regard to a matter which I am sure is as near to your hearts as to ours; the fire loss in general and the electric fire loss in particular. I don't know what your statistics are here, I believe they are even higher than they are in the States, but we calculate we have burned up in the United States, \$350,000,000 a year in the past few years, and that about 20 per cent. of that loss or something like \$24,000,000 is due to electrical fires. The United States Geological Survey has computed that the fire loss in the United States is equal to the production of all the gold, silver, copper and petroleum mined in that country in the same space of time. It is just as foolish and just as reprehensible to do all that production and then to burn it all up. There you are producing things and burning them up and destroying them. In that connection we have arrived at a device which I don't think has been pushed in this country to any great extent and that is the creation of an individual liability law to fire. It has become quite successful in a number of

municipalities. Pennsylvania has passed an enabling act permitting cities of the second class to adopt such an order; Greater New York has that for the city; the State has not, but a bill is about to be presented to the State Legislature under the auspices of the Institute of Architects, and a law has just been presented to the Massachusetts Legislature enabling cities to pass such a law. It is, roughly, where conditions exist on premises contrary to the existing ordinances and the owner of the premises has been advised that his property is not in accordance with the existing ordinances, not his own to the actual value of that property, and he is further responsible for the costs to the municipality of putting out that fire. That law has been passed in several cities and it works. There have been two cases in New York City. One of them was fought and compromised. In the other one there was no dispute at all. That was the case of a film company. They had a lot of films stored and conditions were not in accordance with the existing regulations. A fire occurred and the bill was presented and they sent back a cheque by return mail. They were glad to do it. It served them right.

I believe an ordinance of that kind would be particularly interesting to you, gentlemen, and I think you are in exactly the right position in your various municipalities to suggest and further such a law. The National Fire Protection Association is very keenly interested in that and I happen to be chairman of the sub-committee on that subject. If the Underwriters Laboratories or the National Fire Pro-

tection Association or myself personally can be of the slightest service to any of you here or to any organization that you think of that would be interested in that matter, we should, any of us, be very glad to send our data and to give any advice or even come and talk to you on that or kindred subjects.

MR. E. V. BUCHANAN, London: I think we would like to hear from Mr. Dobson as to the matter brought up by Mr. Cambridge in his letter, that is the fatality that occurred recently in Toronto due to a defective electric heater, and what steps are being taken by the laboratories of the Commission to prevent such accidents happening again.

MR. DOBSON: The fatality in question was caused by an electric air heater of the reflector type. It is one which is in very common use and is a popular type of heater. It was about the first type of heater which had been produced and the same question of the particular defect had come up before. Since then, in fact about three years ago, the manufacturer of this particular device has really rectified that defect in substituting a standard connection of a different design. I can probably illustrate on the blackboard how the thing occurred. (Mr. Dobson made sketch and explained it). That particular type of terminal is practically a standard type and the fatalities that have occurred are very few in number, so that it really should not be taken as a general condemnation of that type of terminal. If we had to change that particular type or design we would probably have to change a

great many irons, heaters and toasters of all kinds which are giving very satisfactory service.

MR. BUCHANAN: What about using a third ground wire on appliances?

MR. DOBSON: It would be very desirable if we could ground the frame of these heaters, especially when used in bathrooms; it would reduce the hazard. This is the third case in the City of Toronto where a heater has been responsible for a fatality.

MR. C. J. LEACOCK: One wire is already grounded. Why not connect that wire?

MR. DOBSON: If you know which one it is, but you would have to have a polarized plug.

MR. LEACOCK: In the old days when somebody was killed, we tried to locate a broken down transformer or a contact between primary and secondary lines. We never supposed for a minute that 110 volts could kill a man.

MR. DOBSON: As a matter of fact you can get killed by 20 volts. This lady of course was right in the bath tub. The case at the technical school was one where he was in a wet, muddy spot.

MR. DOBSON: I can cite another case to show the effect of low voltage. You remember there was a swimmer killed in the Humber river about two years ago the 1st of July. While swimming from one dock to another, he suddenly threw up his hands and sank. He was dead when they got him out. Another boy a short distance behind him also sank, but he was rescued. We went and made an examination and found a condition like this: Here

is a boat house, built over the water, with a motor in it, that pumps water for the use of the boat house. The motor frame is certainly grounded, or you would think it was because it is connected to the water pipe. This boy was swimming along and at about twenty feet away from the motor he was killed. The actual facts of the case were that this motor had become defective, there being a ground on the winding, and consequently the return current through the ground was flowing down to the water pipe and back to the secondary of the transformer by whatever path it could get. We made a voltage survey, at various distances. The first foot from the pipe showed 57 volts, and the next foot less. At about 20 feet out the total voltage was about 98. Where this boy was, there weren't more than about 20 volts between his shoulders and feet. He was paralyzed by that voltage.

I think the Coroner's verdict was that he was paralyzed and drowned.

MR. M. J. McHENRY, Walkerville: I think some scheme for a polarized plug would be advantageous which would permit the grounding of the frames of all portable appliances. If this could be carried out, and I don't see any reason why it couldn't be, I believe it would be very advantageous. I know that there are a number of houses to-day where without actual testing it is impossible to find the neutral wire, and with interchangeable plugs on portable appliances it sometimes leads to difficulties of various kinds. We have had two or three instances on washing machines where rather severe shocks were obtained,

one due to the grounding of the device on the motor which throws out the starter. In one position of the plug there was no shock obtained because that side of the motor was on the neutral side of the line, but with the plug on the other side quite a severe shock was obtained. We have also had trouble with the grounding of switches on washing machine frames and with the frames of various other appliances becoming alive. I believe possibly the best solution would be some form of polarized plug which would permit the connecting of the frame of the appliance to the neutral of the circuit.

THE PRESIDENT: Mr. Heeg raises a question in his letter to us that I think we might have Mr. Dobson answer: What has been the experience with re-fillable type of fuses in the hands of power customers or superintendents and managers.

MR. J. J. HEEG, Guelph: The experience in Guelph with the re-fillable type fuses and ordinary fuses, has, I think, been greater than in most other municipalities, for the simple reason that Guelph has had occasion to take more interest in power users equipment. In the first place we provided motors and later on we maintained them. We find by being in touch with the power users that the re-fillable type fuse, while it is all right as it originally comes from the factory, is very much abused in many ways. The worst of all I think is due to not making proper contact. They put in a new re-fill and tighten up the ferule. It may not be tight enough or it may get loose and the contact become dirty. Then of course it will heat. What I

wanted to bring out was what experience some of the other cities and towns have had along those lines.

MR. S. L. B. LINES, Toronto: Speaking from the manufacturers' point of view, previous to adopting the renewable fuse in our factory we were spending considerable sums per annum. We have now had the renewable fuse in use for over two years with undoubted satisfaction.

MR. MADDEN: I feel certain many of the local managers must hear from time to time from customers who complain they are getting a shock from their washing machines or other appliances. What is the risk? Should any kind of warning be issued to them? Because I am sure that there are heaps of people throughout the province that are getting shocks and thinking nothing of it and possibly they should be warned.

MR. E. V. BUCHANAN, London: On that score I might say that in our little monthly bulletin we issue, we published a warning to our consumers last month about the risk from using appliances; to be careful not to have one hand on any water pipe or gas pipe while touching the frame of an electric appliance with the other, and pointing out clearly the risk involved in doing so.

MR. DOBSON: I think the trouble with the washing machine should be less in the future than it has been in the past because the regulations that have been sent out recently call for the insulation of the motor and its frame from the rest of the washing machine, and the guarding of the same in a suitable manner so that it cannot

become wet. It receives a 900 volt test.

The older types were probably not insulated.

MR. MADDEN: I can see the improvement in design will eliminate the risk, but you can't feel very comfortable knowing that there are hundreds and thousands of appliances out such as this heater with the miserable insulation which is afforded by that washer punched into a little depression in the frame part. Everybody admits it, but the risk must be there if those old appliances are still out. Is it worth while warning the people or are you going to put a poison label on your appliances or what? I don't know what to do?

MR. V. B. COLEMAN, Port Hope: This is certainly a pretty broad question. Of the shocks that have been experienced by people in Port Hope I have had more shocks complained of from irons than anything else. The majority of the laundries are down in the basement and people ironing get shocks when an iron burns out. The statistics go to show every third iron that is burned out becomes grounded when an arc forms in the element, it punctures through the mica and is grounded. I have certainly spent quite a number of very uncomfortable hours thinking over the problem and the risk we really run. I had an accident occur in connection with a bath tub. A lady was taking a bath and she hung a towel over the electric fixture. When she reached up to get the towel, she was burned severely, but not fatally. We get shocks from irons and toasters and from every form of electrical appliance and it appears to me you can't

make electrical appliances that are entirely fool-proof; the only way is in educating the people and warning them. We have pushed the appliance business—in fact I have several times held back from pushing it and allowed the other fellow to push it, knowing and feeling the risks that are run. The only solution is to teach safety in handling appliances in the schools the same as they are taught the dangers of fire.

MR. ARCHIBALD: I think Mr. Coleman is perfectly correct, it is a matter of publicity. We know 100 volts will kill. The only accident we had in Woodstock was through 110 volts. The wireman was doing some repairing, and he was perspiring, making the skin quite moist. The back of his neck touched a water pipe. He was lying on his back, reaching under the floor to cut a wire. He should have opened the switch but didn't. The minute he touched the copper he was killed. There was not a mark on the body but he received enough current to kill him. I measured the voltage to ground and it was just 110 volts. The secondary was perfectly grounded to the water pipes in probably three different places. There were probably 15 or 20 houses with the secondaries grounded inside.

I think it is a matter of publicity. We will have to advertise, as Mr. Coleman says, and educate the children. A few years ago we were almost afraid to say anything about the dangers of electricity because it was going to hurt our business. We have got past that now. We do not need to be so scared of the few dangers. The business is coming as fast as we

can handle it probably, and we should see that the public are educated as to the dangers. I have endeavored through our local papers to have an item appear occasionally along this line. Anything further than that we have not attempted.

MR. MULDAUR: Might I say a word in utmost seriousness as to the selection of electrical devices. Why not select a device that bears the label of the Underwriters Laboratories? I don't mean for a single second that no device which does not bear that is a good one, but I do say without fear of contradiction that a device bearing the Underwriters label is a good one and is safe to handle. The laboratories have been in existence for 19 years in their present condition and they have the respect and confidence of the whole world. A great deal of time can be saved and a great deal of danger obviated by looking for the label. We have a slogan: "Look for the label and you can't go wrong" and it is true.

MR. R. H. MARTINDALE, Sudbury: The polarized plug, in my estimation, is not the solution of the difficulty for this reason: You cannot prevent the average man from cutting a piece of the cord away when it becomes frayed and broken at the plug. The minute he does that, nine times out of ten your neutral is gone. It seems to me the greater the insulation is in portable devices in the frames, the more protection there is in that respect. Also educate the public.

THE PRESIDENT: I would like to ask Mr. Dobson about refillable fuses. What is the experience of the labora-

tory, and also what experience the public has had with them?

MR. DOBSON: Our experience with the fuses has been limited. The municipal managers, I think, are probably in a better position to tell their experience, because after the fuse is approved we don't know really very much about it. The test necessary

for approval consists in proper rating tests and short circuit tests. With the exception of checking up the dimensions to be sure they fit the receptacles, we really have no opportunity to have any experience with these fuses. We only know of isolated cases, and it is pretty hard to draw conclusions from such.

Economical Handling of Range Loads on the Distribution System

By C. E. Schwenger

Engineer of Distribution, Toronto Hydro-Electric System



THE problem of the economical handling of range loads on distribution systems is really the problem of the economical handling of 115-volt loads generally using the data concerning range load characteristics as a guide.

Range loads may fall into one of the following general classes:—

- (1) Concentrated load of several ranges on one service,
- (2) Scattered load of few ranges,
- (3) Heavy range loads more or less evenly distributed.

Each class has its own problem to be solved.

Before undertaking the problems information as to the probable maximum demand on a single range as well as the maximum demand on a group of ranges together should be at

hand. Knowledge of the probable maximum demand will enable us to determine the transformer capacity required to supply the expected load.

Usually the maximum demand of the range or group of ranges will be less than the connected load of the range or group of ranges. The ratio is called Demand Factor which may be defined as follows:—

The Demand Factor of a section is the ratio of the maximum demand on this section to the connected load on the section.

Tests conducted by the writer show that where a group of ranges greater than ten is being supplied, a demand factor of about 33 per cent. is obtained. Thus for every 100 kw. connected in ranges lamps and appliances a maximum demand of 33 kw. may be expected.

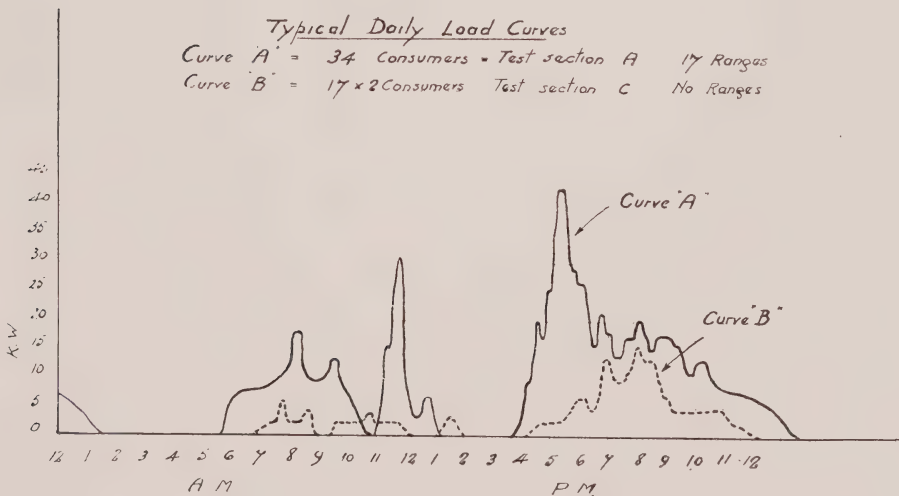
This demand factor was obtained from the following test data:—

TESTS

	Section A	Section B	Section C
Length of section	700 ft.	800 ft.	
No. of Consumers	34	38	17
No. of Ranges	17	18	none
Connected load ranges	105.5 kw.	123	none
Connected load other than ranges (estimated)	25.0 kw.	28.5	13
Total connected load	130.5 kw.	151.5	13

MAXIMUM DEMANDS (Daily)

Friday	5.20 p.m.	36.2 kw.	Tues. 24.2	Tues. 8 p.m. 7.5
Sat. and Sun.	5.55 p.m. Sat.	26.0 kw.	Wed. 40.0	
Monday	5.15 p.m.	43.7 kw.	Thur. 33.0	
Tuesday	5.30 p.m.	43.5 kw.	Fri. 42.5	
Wednesday	5.30 p.m.	35.5 kw.	Sat. 34.6	
Thursday	5.25 p.m.	37.0 kw.	Sun. 20.0	
Friday	6.00 p.m.	42.0 kw.	Mon. 47.0	
Saturday	5.30 p.m.	28.0 kw.		
Sunday	6.00 p.m.	21.0 kw.		
Greatest for week		43.7 kw.	47.	
Demand Factor		33.3%	31.5	57%
Date of Tests	Dec. 1920	Dec. 1920	Dec. 1920	Dec. 1920



The typical curve "A" shows that the period over which the maximum demand takes place lasts less than one hour, and takes place between five and six p.m. The chart is typical for conditions in large cities such as Toronto. This demand includes lighting and appliance load as well, and the lower curve "B" shows the lighting and appliance load only. This latter curve was secured on Test Section C which has no ranges but has the same class of consumer. The range peak and the lighting load overlaps on the date in question which is one early in December.

In smaller towns, where the noon meal is the most important of the day, it is likely that the range peak would occur between the hours of 11 a.m. and 12 noon. This peak would not overlap the lighting load but might overlap a small appliance load as shown. The maximum demand on any section would, therefore, be somewhat smaller than for a similar section in a large city.

Thus for concentrated load of several ranges,

(GENERAL CLASS No. 1) COVERING SUCH LOADS AS APARTMENT HOUSES. Knowing the connected load in ranges and other devices, we should install a transformer of size capable of handling a demand of 33 per cent. of the connected load. The typical curve shows the demand to be of short duration. For such short periods transformers can easily carry 50 per cent. overload, therefore to carry the above load, transformers rated at two-thirds of the maximum demand may be used, which in the case above

equals 22 per cent. of the connected load.

The rule might be stated that transformer capacities of 20 per cent. of connected load should be installed as a minimum for the purpose of carrying range loads. The transformer should be installed as near the load as possible which for apartments would be near the service entrance.

CLASS II. SCATTERED LOAD SUCH AS OLDER BUILT UP DISTRICTS WHERE A FEW RANGES HERE AND THERE ARE TO BE HANDLED.

The maximum demand for a single range is approximately 50 per cent. of its connected load. Thus for a 5 kw. range the demand would probably be $2\frac{1}{2}$ kw. Usually secondary lines laid out for general lighting could handle one or two ranges in addition without installing extra transformer capacity. This is on account of the slight overlap of the two loads. Voltage regulation may enter into the problem and it may be necessary to change the location of the transformer to a point closer to the range loads under consideration. This will depend on local conditions which will have to be considered for each individual case.

CLASS III. HEAVY RANGE LOADS MORE OR LESS EVENLY DISTRIBUTED ALONG A STREET.

Let us assume the load as evenly distributed for the purpose of calculation. Let us also assume the distribution to be at 115/230 volts, 3-wire and that primary wires are available along the street so that this latter item may be neglected in the calculations.

From the data on hand we find that we may expect a maximum demand

per thousand feet of secondary lines of 75 kw. Taking Test Section "A," out of 34 consumers on 700 feet of line, we get a demand of 43.7 kw. which is equal to 62 kw. per thousand feet of line. Here, however, one out of every two consumers now has a range. This ratio might easily become larger later. Therefore, the estimate of 75 kw. per thousand feet does not appear to be too high.

The problem now is to decide on the size of secondary wires, and the transformer spacing, to obtain the most economical condition.

Taking No. 6, No. 4, No. 2, No. 0 and No. 3/0 as standard conductors, and working out the total annual charges per thousand feet of secondaries including transformers, and also the annual energy loss costs, the three following tables have been obtained.

Annual charges for secondary copper is figured at 10 per cent. and includes interest depreciation and sinking fund. Similarly the rate on transformers is figured at 13 per cent. Energy loss in secondary wires and transformer copper is figured at 1 cent per kilowatt hour. Transformer core loss is included in transformer annual cost. This, however, does not affect result if omitted.

By transformer spacing is meant the distance between transformers on a secondary if the transformers are banked. If not banked the transformer spacing will become the distance between the ends of the secondary section having the transformers in the centre. The energy loss is assumed to be that due to the use of the peak load for $1\frac{1}{2}$ hours, see Curve "A," and as being equivalent to the average daily loss over a yearly period.

ANNUAL CHARGES PER THOUSAND FEET OF SECONDARY CIRCUIT,
LOAD=75 kw.

TABLE I.—800 ft. Transformer Spacing
Annual charges per 1,000 ft. of secondaries

Size Wire	Wire Annual Carrying Chgs.	Sec. Cu. Loss	Transf. Cu. Loss	Transfs.	Drop at 230 V.	Total Carrying Charges.
6	13.67	24.50	11.09	138.13	25.6	187.44
4	19.55	15.45	11.09	138.13	16.4	184.27
2	26.21	9.67	11.09	138.13	10.2	185.15
0	40.57	6.08	11.09	138.13	6.4	195.92
3/0	65.52	3.85	11.09	138.13	4.1	218.64

TABLE II.—1,000 ft. Transformer Spacing
Annual charges per 1,000 ft. of secondaries

6	13.67	37.50	11.09	120.00	30.0	183.26
4	19.55	24.22	11.09	120.00	20.0	174.86
2	26.21	15.20	11.09	120.00	12.5	172.50
0	40.57	9.55	11.09	120.00	7.9	181.21
3/0	65.52	6.04	11.09	120.00	5.0	202.65

TABLE III.—1,200 ft. Transformer Spacing
Annual charges per 1,000 ft. of secondaries

4	19.55	34.70	11.09	115.92	29.	181.26
2	26.21	21.68	11.09	115.92	18.3	174.90
0	40.57	13.70	11.09	115.92	11.4	181.28
3/0	65.52	8.14	11.09	115.92	7.3	200.67

From these tables it is evident that lowest annual fixed charge is for No. 2 wire having 1,000-foot transformer spacing. This is, therefore, the most economical. This combination gives a maximum voltage drop of 11.5 or 5.4 per cent. which is not excessive. However, a better voltage regulation than this is required, let us take No. 0 wire having 1,000-foot spacing. This gives a voltage drop of 7.9 or 3.6 per cent. at annual fixed cost of \$181.21.

Now let us see what we get with other transformer spacings for this annual outlay. The best in Table No. 1 is \$181.21 but voltage drop is 16.4 or 7.1 per cent., and therefore not as good as No. 0 with 1,000-foot spacing. The best in Table No. 3 is No. 0 at \$181.21 per year but drop is 11.4 volts or 5 per cent. which also is not so good as No. 0 in Table 2.

It would, therefore, be good policy to adopt No. 0 secondaries with transformers at 1,000-foot spacing as for the slight annual extra outlay better voltage regulation is obtained.

The above has been outlined in some detail to show the method of obtaining the most economical conditions.

Similar tables may be worked out to find the most economical layout for other load densities if this were wanted.

In laying out new lines for districts where the load will later on reach a density of 75 kw. per 1,000 feet, it is best policy to install the secondary copper of size sufficient to carry the ultimate load, No. 0, but to provide only sufficient transformer capacity

on 1,000-foot spacing to carry the immediate demands, and later change the transformers to greater capacity as the load increases.

This is more economical than to install secondaries of smaller capacity with the idea of later changing both secondaries and transformers as the load demands it. This is on account of the heavy charge for replacing secondary wires, and also on the loss in capital value of the wires recovered.

Take for Example that

Present demands warrant No. 4 secondaries. Annual charges for this wire, \$19.55.

As above No. 0 should be installed as ultimate size. Annual charges, \$40.57.

Use of No. 0 makes an Annual extra outlay, \$21.00.

Now cost of removing No. 4 secondaries and reconstruction to erect No. 0 secondaries per 1,000 feet equals approx. for labor\$100.00

It must be remembered that service wires have to be disconnected and again reconnected to No. 0 lines.

Original cost of putting up	
No. 4, Labor	32.17
Extra—Depreciation on wire due to its having been cut into, etc., estimated at	40.00

Total cost\$172.17

Thus if change is to be made in less than 8 years it will pay to put up No. 0 in first instance as the extra annual outlay over the No. 4 would in 8

years amount to \$168.00 which is approximately the cost involved in later changing the wire sizes. If sizes closer together such as No. 4 and No. 2 are compared, it will be found uneconomical to make the change in less than 24 years.

Annual charges No. 4.....	19.55
Annual charges No. 2.....	26.21
	— —
Extra annual charge	6.66
Cost to remove No. 4 and re- construct alter (approx.).....	90.00
Original cost of No. 4 labor putting up (approx.).....	32.17
Extra depreciation estimated....	40.00
	— — — —
	162.17

Thus 24 years of extra carrying charges on No. 2 over No. 4 approximate the total cost of later changing the wires.

No mention has been made as to the relative cost of annual energy losses, but it is readily seen that the losses for the smaller wire will be the larger thus tending to increase the time period under which it would be uneconomical to change wire sizes.

The writer has introduced this feature to show that good economy results by putting up at once the wire size corresponding to the ultimate requirements, unless the ultimate load will take many years to develop.

GENERAL REMARKS

For range loads continuity of service is of prime importance even more than for lighting only. In pure light-

ing loads, if an interruption takes place, some other source of lighting such as candles, oil lamps, etc. may be resorted to without great inconvenience to temporarily tide over the emergency. This is not so with electric ranges where these are used exclusively as is generally the case.

The writer would recommend that ranges be connected for 3 wire operation and that secondary lines be supplied by transformers connected in series, that is, to obtain 115/230 volts, two transformers each connected for 115 volts in series across the secondary lines. In case of transformer trouble, if one transformer is interrupted through any cause, only one side of the secondaries is affected, the other side will be in operating condition, and one-half of every range may still be used. Thus only a partial inconvenience results for the consumer until such time that the necessary emergency work on the transformer in trouble may be done.

The cases taken above are for winter conditions when range loads lighting, and appliance loads overlap slightly and thus are maximum loading conditions. These of course are the ones for which to lay out the lines. This overlapping takes place only during, at most three winter months. During the balance of the year the loads do not overlap and, therefore, the maximum demands would be smaller. This is a desirable condition as, the transformers then have a higher normal operating temperature and a somewhat less overload capacity.

Discussion

MR. R. H. STARR, Orillia: I would like to thank Mr. Schwenger for this very interesting paper. I think one thing that was brought out in it—I have forgotten the words now—was with reference to the average load that you get in connection with ranges. We have about 300 customers on meter and about 1,800 on flat rate. The range runs about 55 amperes and my experience has been that you can figure about three 65 ampere ranges on a $7\frac{1}{2}$ k.w. transformer. The tendency is to overload your transformer, but where we have the flat rate and know fairly well what the connected load is on appliances there is not the same tendency. I think great care should be taken to check up constantly the load on transformers, because you will find that whereas your diversity factor is sometimes say 30 to 40 per cent. in one section, in other cases it will range as high as 75 per cent., and allowing for 25 per cent. of overload for two hours at the peak, you will find if you don't check up your loads on these transformers, the transformers will be carrying 100 per cent. overload.

Possibly that is due to us having a flat rate and people are inclined to leave their lights on, but I think those using meters would save a whole lot of burned out transformers if they would make a periodical examination of the loads on their transformers.

MR. A. W. J. STEWART, Toronto: There is one point in connection with putting up heavy enough lines in the first place that is very important to the appliance end and that is to make

lines heavy enough, so that the customers will get good results from the range. I have looked up some information which the Society of Electrical Development collected and they found a drop in the voltage of ten per cent. increased the time for heating an oven about 40 per cent. If the voltage is down ten per cent. it will take 40 per cent longer. That means the customer will be dissatisfied with the longer time taken, and they will also use about 16 per cent. more kilowatt hours to get the same result, so that the customer will pay more to get the results.

From Mr. Schwenger's figures apparently a thousand feet of line with transformers would cost \$120 a year for carrying charges above the cost of an ordinary line for lighting only. On a thousand feet of line where ranges are close, like in the cases he has investigated, you get probably twenty-five ranges in that thousand feet; they would figure out at 40 cents per month for each range as an extra lighting charge. I have looked up the bills these customers have paid in three districts, three different streets in the city. Two of them were where there are ranges. The houses on the street where there is no range installed had an average bill of one dollar and one cent. On one street where they had ranges installed those ranges averaged \$3.47; their cooking cost them \$2.46 higher than their neighbors who had lighting only. On the other street it amounted to \$1.72 or approximately \$2.00 a month for their cooking. They are getting a revenue of \$2.00 a month there and the carrying

charges on the extra line of transformers is only 40 cents a month, and it looks like pretty good business for the station. At the same time the customer is getting his cooking for \$2.00 a month, so that it looks as though it is well worth while to put up sufficient capacity to take care of the customer, and to push the sale of ranges on that basis.

MR. E. V. BUCHANAN, London: I do not wish to appear over critical of Mr. Schwenger's paper, but do not think his calculations are of much practical value. He states that the energy loss is assumed to be that due to the use of peak load for one and one-half hours. I cannot see the reason for this assumption, and I am inclined to think that a further investigation of the question would give a value which would make considerable difference in the results.

When we are about to build a distribution system, we know that we must not allow our voltage drop to exceed 10%, as we would soon receive complaints from customers. Mr. Schwenger's point of view was that it was out of the question to try to run a range when the voltage drop was over 10%. Proceeding with your calculation as to size of wire, on the assumption that the voltage drop will be between 5% and 10%, you get results which eliminate more than half of the examples submitted in Mr. Schwenger's table, so that half of the figures in the table are without practical value. Comparing the remaining figures, there is little difference between the annual carrying charges. Mr. Schwenger admits this, by advis-

ing us to adopt No. 0 copper instead of No. 2, so that we would doubtless arrive at this result when basing our calculations on a reasonable voltage drop.

I quite agree we ought to have heavier copper when putting up a line, to meet the extra demands, but the changing of copper is not such a serious item as Mr. Schwenger makes it out to be. For example, in his first example, why should the cost of changing copper include the initial cost of installation? If the initial cost of installation is lost, we must only add the cost of taking down the old copper, as the cost of putting up the new copper is an asset. Thus instead of the cost of changing the line being \$172.00, it would only be \$140.00. Again Mr. Schwenger states that in eight years the extra carrying cost would equal the cost of changing the line. Mr. Schwenger forgets to compound the interest charges on the saving. If you save \$21.00 in the first year, you have to compound the interest on that for eight years at 6%, and the interest on the \$21.00 saved in the second year for seven years and so on down the line, to get the correct saving. Therefore in eight years you have a saving of \$220.00, and the cost of changing of \$140.00 which would show a net saving, if you did not make the change for eight years, of about \$80.00. In his second example the compounding of the interest on the saving is even a greater factor, and instead of breaking even in twenty-four years, we would break even in about fourteen.

The suggestion that Mr. Schwenger makes of connecting transformers in

series is a very good one from the operating point of view, but it is not the most economical method, because, for example, two 10 k.w. transformers instead of one 20 k.w. transformer, would add considerably to the annual charges, but as I said before, the idea is an excellent one from the point of view of operation, and I believe is justified even at the additional expense.

With regard to the demand factor, the conditions set forth by Mr. Schwenger may be typical of Toronto, but they certainly do not represent the situation in smaller cities. Even with apartment house loads in London, we find that the demand factor would be about 23% or 24%. This example is taken from an apartment house of about seventy apartments, with twenty ranges. In other residential districts we have an example of ninety-eight consumers with ten ranges, the demand factor being only 19% in this case; and another of seventy-four consumers with twenty-two ranges, the demand factor being 16%. I think one could safely put up a transformer with a capacity of less than 20% of the connected load. Again the examples are not applicable to the smaller cities, because the sections fed, sometimes are as much as 2,000 feet, as compared with the examples shown as 800 feet, 1,000 feet or 1,200 feet.

I would emphasize what Mr. Starr has said regarding the checking up of the loads on transformers. In London, we use Esterline graphic ammeters which we find very useful for that purpose. We change them from one transformer to another taking

two or three days on each transformer.

In conclusion I think we are much indebted to Mr. Schwenger for his paper. The points brought out are extremely interesting, as also are the curves shown.

MR. H. C. POWELL, Toronto: I wish to make a few remarks in regard to trying to keep the ranges from coming in too fast on the line. There are two reasons for that, the first one is that in the older sections of the city the lines have already been installed for lighting and when two or three ranges are added it is necessary to pull those lines out and put up larger capacity. In handling the accounting for that operation it is usually taken care of in this way, the original labor cost of the original line is left in capital, the labor cost of installing the new lines is charged in the year's operating expenses. The material cost of the original lines is removed from capital and the material cost of the new lines is charged to capital. From that we discover that if we have a great many streets in the city to be re-built that our operating expenses for that year are going to be considerably increased on account of the reconstruction charges. The income from the range does not begin to pay for those costs in that particular year, and it seems to me that unless the rates for ranges are made large enough for the operating utility, to come somewhere near to paying those extra expenses that we are not getting enough money.

In looking over some of the figures of construction costs and various costs I find that the costs for installa-

tion are higher than the income, and that the income from some of the residence rates which are now charged in some of the municipalities is very low. For instance some of the range customers are paying at approximately one cent per kilowatt hour, and in looking over the cost of some of the utilities I find that their total annual costs, including the cost of ranges, current, and operating expenses and fixed charges is about one and one-third cents per kilowatt hour. I think we should be very careful and not allow too many ranges to come on too suddenly. There are two reasons why these ranges are not coming on suddenly now. The first reason is that the first cost of the ranges is so high. A 60 ampere range is selling now-a-days for \$144 plus the cost of installation—some contractors charge \$50 for installing that range; others, if you can get them to cut off a little, might put it in for about \$35 or \$40. There are a large number of people in the city who are waiting patiently for the cost of ranges and the cost of installation to come down. There is another reason why ranges are not coming on very fast, and that is there is not enough power to supply them. There has been a ban on the amount of power that has been available for ranges in the last six months. I hope that soon the ban will be lifted so that we can give the consumers in outlying districts the opportunity of having ranges. In the City of Toronto we have much difficulty with gas, the gas is very poor. There are a lot of customers who would like to have electric ranges. So my word is to the range manufacturers to try to bring

down the cost of their ranges to help the people. My advice to the operating utilities is to try and keep the ranges off the line.

MR. STEWART: I agree with Mr. Powell that one of the reasons for ranges not going on now is on account of the power shortage. The other reason is not nearly so important, because although it costs \$140 to buy a range without installation, that is not very much if you compare it to the price of any decent gas range, and if you take the relative bill as to the cost of electricity and put that side by side with gas, and take the advantages of the electric range there is no question to it that as soon as we can get power the engineering department can go to work building lines.

MR. P. B. YATES, St. Catharines: I was very much interested in the prospect of hearing this paper and hearing what Mr. Schwenger would say. When I got the advance copy I had the superintendent look it over, and I took a little look at it, and we talked the thing over generally. Unfortunately, it doesn't give us any information. Conditions in smaller cities are absolutely different from those in Toronto. In our town, under normal conditions, if we didn't have a range on we would have a day peak and a morning peak during the summer months. During this last winter we have had no month when we had an afternoon peak; they have all been either between half-past seven and eight in the morning or between eleven and twelve in the morning, so that our conditions are different. Mr. Schwenger will say possibly we get an ad-

vantageous stove load, because you have not got to take care of the transformer capacity for your stove load and your lighting load. But you have got to take care of the stove load and appliances load, which is becoming very heavy, especially on Tuesdays, ironing day. Tuesday is our peak day almost without exception. You take the ordinary house; the lighting peak will seldom reach the demand of an iron or other appliance, and in the smaller cities help is hard to obtain and the homes do their own ironing to a large extent, or some of it, and it comes on Tuesday, and on top of that we get our cooking load. Monday is wash day, consequently you don't do much cooking, you have your cold food from Sunday and have got your cold roast, but on Tuesday you have got to do some cooking, and on top of that you have your appliances load. That is when we find our conditions are the worst. So that we are different there.

Mr. Schwenger talks about a 75 kilowatt load or something of the sort in a thousand feet. You don't have 150-foot fronts in St. Catharines very often. I don't claim to be a millionaire or live in the best section but I have a fifty-foot front. The lot next to me is 80 feet, and we have got one across the street of 100 feet. Now, in this kind of a district you can't get the dense load that Mr. Schwenger refers to, and for that reason you have got to carry the output of that transformer further, and therefore have to use more copper. The demand factor we find in our case compares more favorably with what Mr. Buchanan has stated. We

have one section of 1,100 feet with 39 consumers and 16 stoves. Assuming a connected load the same as Mr. Schwenger has assumed, we have a load of 133 kilowatts there and we are carrying it on a 15, which is a demand factor of 11.3 instead of 26.6—20 per cent. of the connected load. That is the most dense load we have in any section of the city and it happens to be in one of the newer sections with four to six-roomed cottages, and 25 to 30 foot lots and hits both sides of the street. We have one of 1,550 feet, 44 consumers and 13 stoves. I think there is a transformer capacity of 20 kilowatts. Another with 28 consumers and 6 stoves has 10 kilowatts. Those are a demand factor of 17 in one case and 16.7 in the other which checks up with Mr. Buchanan. But those are exceptional conditions for St. Catharines. Our load from a transformer in almost every case will run a thousand feet from the transformer. That is, we have to feed a thousand feet from the transformer. So that I am afraid the information given me there does not compare with ours and we will have to work out our own.

Mr. Stewart, of the Toronto Hydro, gave a comparison of bills showing the difference in receipts from stove consumers and from ordinary lighting consumers, showing that the difference in the monthly power bill would very well cover the extra expense of connecting up these consumers. I thought that our cost of service was to be taken care of by our service charge. If we have got to take from our power receipts of our domestic consumers a portion of their

bill to cover service are we going to get enough for our power? \$2.00 is the ordinary stove bill. 60 cents is the ordinary lighting bill. \$1.40 is the difference. Our power costs us a little over \$14 a horsepower. Mr. Schwenger figures that we have to allow over a kilowatt for a stove. We believe that is true, about a kilowatt for a stove, one and one-third horsepower. That in our bill is nearly \$20. We can't afford to take anything even on Mr. Schwenger's figures from our power bill to cover the extra cost of service, and our extra service cost in our case will far exceed what is given in the paper. This thing has been discussed a great many times and it seems to me that some more definite figure should be made. It seems to me that with the growth of the range business it is worthy the study of a special department of the staff of the Commission for some considerable time to thoroughly go into this matter. We have had stoves on our system that cost us \$2,000 to hook up. You figure that possibly sometime you are going to get enough to cover that, and you may, but your \$2,000 is piling up fast every year. If we put in secondary distribution in the new sections of the city big enough to take care of what may grow there we have got to figure that all around the outskirts of the city we have got a network of secondary that is eating its head off until the load does grow. It may grow with the range load or Gas Company may decide to run a new main there and we won't get as much business. It is a risk—very risky business and it should be made to stand on its own feet.

MR. E. M. ASHWORTH, Toronto: There is just one point I would like to mention that occurred to me, and that is the difficulty of making any accurate or precise figures in connection with a matter of that sort. You make an assumption which is perhaps an accuracy in the general way of 2 per cent., and it is simply deceiving yourselves to try to follow that up with compounding the interest or by the mean square. You have to use a great deal of intuition. In making a study of a thing like this you have to take very general assumptions or else the best thing you can do is to start in to write a large book and consider every possible case, working it out to the last detail, and that, in practical operating, is not possible. You can make an occasional study of conditions as you find them. I think perhaps that is what Mr. Schwenger has attempted to do, and to my mind his recommendations seem to be rather wise. Whatever his methods of approximations may have been, his conclusions are that you should put in good big wires to take care of the increase in the load, and that I think is a conclusion that is borne out by the experience of every one connected with the Hydro. It is quite true if you write a paper that is based on approximations and more or less on intuitions you are open to criticism from every source. I should say it is much easier to criticize such a paper than to answer the criticisms off-hand. But I think the general conclusions of the paper are fairly correct.

MR. SCHWENGER: Replying to Mr. Buchanan, he criticizes the assump-

tion that the losses are to be figured on the one and one-half hour use of the maximum demand. This test is the maximum during the week. I would assume one and one-half hours to be the average during the whole year. It means, to do that accurately, we would have to take a test every day during the year, and I have had I think less than three weeks to get this paper together. It was thrust upon me at the last minute, and I had to do that, and I think I was fairly correct in doing it. This was the result of ten tests I took before I prepared the paper, and I am glad it brought up the discussion that it did. but I wish to point out that the one and one-half hour use is every day over the whole year

Mr Buchanan criticized the point where I mention that the original labor of installing first sized wire is lost. When a wire is put up you charge labor and material to capital. When it is taken down you don't recover that labor, it is lost, and you spend the extra money to take it down again and put up a new size. I am not an accountant, but I think the assumption is correct, that the original installation labor is lost and that the other labor of putting it up again in the second instance is a reconstruction charge.

The question of compound interest was brought up. I think that is well counterbalanced by the fact that I have not taken into the calculation the extra loss on smaller wire during the term of its use. I had no chance to do that on account of the limited time, but I think it is well counterbalanced by that item. I have given

outside figures here to show the point of the argument, namely, that wires should not be put up too small unless they have to be charged over a long period. It takes a long time for the load to develop. I think Mr. Yates bore that out with his experience in St. Catharines.

Regarding the use of the two transformers in series, that is a supplement to the economical end of it in money with the idea of bringing out economy in operation as you mention. While there is a difference it is not so large as would seem when you consider the large loads we are using here and which we are getting regularly in the newer districts in Toronto.

The point I wished to bring home was the method of arriving at these economical conditions. For instance Mr. Buchanan mentioned he supplied, I forget the number of ranges, 2,000 feet from the transformer. I would be interested to know what the voltage conditions are with any loading of this kind or approaching this kind, and what the load density would be, if it is anything like that. I am interested in that because I haven't got that data for London. The data I had was for Toronto, and anything like that will help in arriving at future conclusions.

Replying to Mr. Yates, Mr. Yates mentioned that Tuesday was a big appliance day. We find that the case as well. On Tuesday, we get a considerable morning load, apparently the iron load, but this particular peak load took place on Monday. Another interesting thing which I think I might point out is the diversity factor that it takes a lot of investigating to

get. I wouldn't be able to do that. You will notice these peaks are very sharp, on other days you get this spread over a little, and under those conditions a demand factor of 16 or 20 per cent. as obtained in London would apply, but this is the worst condition we could obtain and that is the condition for which the system is designed—not the average condition, but the worst condition.

Mr. Yates mentioned that he was carrying 16 ranges on a 15 kw. trans-

former. Did Mr. Yates get the load test on the transformer, the actual load that was being supplied? We have run across cases like that where ranges have come on unknown to us and we have run as high as 100 per cent. overload on transformers successfully. But that is too much for the transformer. I think my figure of 50 per cent. overload is a little more reasonable and fairer to the transformer.

Discussion on the Report Presented to the Ontario Government on

“A More Equitable System of Distribution of Hydro-Electric Power and a More Uniform Price.”

MR. E. I. SIFTON, Hamilton: Mr. Chairman, there are thirteen pages of this, an unlucky number, but it is very interesting reading. However, if you will allow me, instead of reading thirteen pages, I will try to give you a short summary of it, quoting certain sections.

It starts out with the proposition of verifying their ideas and giving grounds or excuses for their method of taxing us on power. Their method is to charge a tax on all water generated power in Ontario of \$2 per horsepower. There are a number of taxes paid now which possibly they might not eliminate, but this is a special tax of \$2. They list a lot of places that are paying, some paying as high as \$2 to the Dominion Government, others

paying 50 cents and so on. Their method of handling that is summarized on page 11, together with what they propose to do with the money they get. It would give them a revenue of approximately \$2,000,000. They also propose that all Hydro systems, mainly Ontario, be taxed in the ordinary way, which, they claim, would give them a revenue of about \$500,000. That would make \$2,500,000 revenue. I will read this part as to what they propose. “Your Committee would therefore recommend that if a Department of Power be established, the Minister in Charge should be authorized under regulations to assist municipalities and rural power zones, where formed with the approval of the Minister in the following manner:

1st. Where the cost of power supplied to any municipality or power zone is in excess of \$30 per horsepower per year and the distributing system is owned and operated by the municipality or local commission or supplied by the Hydro-Electric Power Commission of Ontario, then the Minister of Power may authorize to be paid, out of the revenues of the Province to the commission of such municipality or power zone, a sum equal to 50 per cent. of the additional cost in excess of \$30 per horsepower; but the maximum amount of assistance by the Province to any such Commission shall not be in excess of \$25 per horsepower per year."

That means, if the municipality was buying power now at \$60 they would get an allowance of \$15, or one-half of the excess over \$30. That would be a reduction in the price of power to that municipality or power zone which would include the surrounding district, probably five miles from the town.

The second clause is, "When power is supplied to the agricultural industries" I presume that means farmers, "under the conditions outlined in clause 1, then the Minister of Power may give further assistance by granting to the local commission of the municipality or power zone a sum sufficient to meet 80 per cent. of the annual charge necessary to pay for the cost of building and maintaining in rural districts the low tension transmission lines that are necessary for rural distribution, but that such assistance shall not exceed 50 per cent of the revenue derived from power rentals," if you can get that—I haven't

yet, "and that one of the conditions upon which such assistance may be given is that there must be an average of three services per mile of transmission line in all rural districts served."

To understand that you would have to do some figuring, to pay 80 per cent. of the cost of building and maintaining in rural districts the low tension transmission lines. That is indefinite. If you come back to the low tension, calling 110-220 or even 550 volts, low tension it is getting a long way from the primary line. It is difficult to tell what they mean in this case; and when they speak of 12,000 miles of line to be built in rural districts in the first year or two, it is very difficult, without a lot of estimates being prepared, to tell where this is going to land us or what is going to happen. They go on to say that it will only mean four cents in London, I think it is, five cents in Hamilton and six cents in Toronto per consumer per month, on the residence lighting bills. I don't follow them as to why they give London credit for only having four cents added there because they are under the \$30 price. When all three of the cities have the same rate, three, two and one cents, I don't see how they figure it out that way. But at the same time when you stop to figure that on one customer that the City of Hamilton has it will mean about \$18,000 a year to that one customer. It looks as if he will be helping the farmers considerably.

There is some very interesting reading here. There is one point I know will interest you right at the first: "Your Committee can see no reason

whatever why a great undertaking like the Hydro-Electric system should be exempted from taxation in order to furnish cheaper powers for our cities, towns and manufacturing industries which can well afford to pay, and your Committee regards such exemption as a system of bonusing in its most vicious form." I hope you all appreciate the class of customers you are dealing with in your municipality, receiving bonuses in such a vicious form as this.

Roughly, the only argument that I see is along the line of the Province handling public assets. They have a clause here, "Your Committee is further influenced in making its recommendation that a Department of Power be established, by a review of the receipts and expenditures of some of the principal Departments of the Government." Under the Departments of Lands, Forests and Mines, water powers brings in \$19,787, and they have an expenditure of \$165,500, with a deficit of \$145,713, with a liability unknown, they say. That is, the municipalities carried the original liability but the government doesn't know where they are at as to what might happen in connection with their liability. That is their one particular argument for a tax on power.

MR. R. T. JEFFERY, H.E.P.C. of Ontario: From remarks which I have heard in conversation with various members at the Convention, I find there appears to be a misunderstanding in connection with certain suggestions made some time ago by Sir Adam Beck regarding the matter of the Provincial Government granting certain monies to help defray the cost

of construction of rural lines, and before the discussion in connection with the Report on Flat Rates takes place, I think it might be well to clear up any misunderstanding that may exist in the minds of any of the delegates present and make Sir Adam's statement regarding this matter clear.

I discussed the matter in question with Mr. Gaby this morning to see that my understanding therewith was correct, and to get certain additional information from him in regard to different points, which, I, myself, did not fully understand.

Perhaps I had better first explain the disposition of the Water Rentals collected on the various Water Powers throughout the province, so that you will understand just where the money goes.

The Water Rentals for power developed on navigable streams is collected by the Dominion Government, and none of this money is collected by the Provincial Government. The Water Rentals for power developed on other than navigable streams, with the exception of such water powers as are held in free hold by certain private individuals, goes to the province. The province, however, has not been, up to the present, and is not now collecting all of these water rentals. It has, however, been collecting a part of it. The water rentals collected from the Power Companies at Niagara Falls is collected by the Province. When I say "the Province," I mean the Queen Victoria Niagara Falls Park Commission, which Commission is appointed by the Provincial Government, and is under Government control, and, therefore,

the water rentals that are obtained from the Power Companies at Niagara Falls, are under the control of the Provincial Government to do with as they may choose, and if they choose to devote this money all to the up-keep and maintenance of Parks, etc., at Niagara Falls, that, of course, is entirely the Government's option.

Sir Adam's proposition to the Provincial Government, as I understand it, was that Sir Adam suggested, as regards assistance to rural districts, that the Provincial Government should collect all of these water rentals that are due, and that the Provincial Government should also be allotted a portion of the water rentals on the navigable streams, all of which rentals are now collected by the Dominion Government. His proposition was that the water rentals for additional power that should be generated from time to time at Niagara Falls, and at other points in the Province, should be collected by the Provincial Government, and part of this revenue so collected should, he suggested, be used by the Provincial Government to pay a part of the capital cost on rural lines to assist rural communities in obtaining electric power. It appears, however, that some person has misunderstood, or misconstrued his idea regarding the matter of assisting rural communities, and, I think, we have today in the Report of the Commission, which you are about to discuss, a misconception of his ideas along this line.

The water rentals for power supplied from the development on navigable streams, and for developments on other streams throughout the Province vary from 50c. to \$3.00 per

horsepower per year. The reason for the variation is on account of the cost of permanent works that have been installed by the Dominion Government at certain points on navigable streams; for instance, on the Trent Valley Canal and on the Rideau Canal, the Dominion Government has installed certain dams, and other permanent works, which are used jointly for navigation purposes, and, also, by the Power Companies to generate power, and, therefore, the water rentals for power supplied from works partly constructed by the Dominion Government should be more than rentals from water powers generated from points where the site only of the water power is used by the Power Company in installing their development, and all capital expenditures in connection therewith are made by the Power Company. It is, therefore, not fair to charge the Power Company the same water rental for the use of the water where they have to spend all of the capital for the development, as it is where the Dominion Government pay for the dams and other permanent works in connection therewith.

If the balance of the water available for power generation at Niagara Falls were used in the immediate vicinity of Niagara Falls, as is the case of the Ontario Power Company, the Canadian Niagara Power Company and the Electrical Development Company, instead of being taken through a canal to Queenston, as is being done in the case of the Queenston-Chippawa Development, we would only get one-half of the amount of power out of the same amount of water, as it is proposed to obtain in the Queenston-

Chippawa Development, and if, as is proposed in this Report, a flat charge of say \$2.00 per horsepower on the amount of power developed is made, there would not be very much incentive for any individual, or any company, or any Commission, to spend a lot of capital to develop the water powers of the Province efficiently.

I might say that the proposed \$2.00 water rental charge is equal to the total cost per horsepower of the complete generating equipment that will be installed in the Queenston Plant—That gentlemen, is what I wish to explain in connection with the apparent misunderstanding of Sir Adam's suggestion regarding the matter of the Provincial Government assisting in the matter of construction of rural lines. His suggestion is entirely different from the recommendation, as set out in the report, which you are about to discuss.

THE PRESIDENT: I think the best way to continue this discussion is to call upon members in different sections of the Niagara district. I will first call on Mr. Yates who is right at the power plant practically.

MR. P. B. YATES, St. Catharines: Gentlemen, we have in the approaching completion of the Chippawa plant a pretty large proposition on our hands. We have got a very large investment in it which is a direct liability on the municipalities. Of course the province has guaranteed the account but I think that the municipalities are pretty good for it and they will be held good, especially under the present Government.

We have got to sell that power in order to carry our costs, and we have

got a considerable proposition ahead of us. We are competing with the Province of Quebec which in some ways is more favorably situated than we are for industrial propositions. We have here a large amount of power. Quebec has a lot of power and a lot more to develop, and if we are going to handicap the Province of Ontario by increasing the cost of power, we are not going to sell that power, and the cost of power is going to stay up on the Chippawa plant. It is going to be too expensive to sell. We have complained about the increase in capital cost of the Chippawa plant now due to the exactions of labor during the last few years, but here is something that is going to increase the cost of the power from the Chippawa plant a whole lot more than the exactions of labor.

It seems to me these people, this committee made up of three farmers, a plumber and a retired gentleman, have hardly gone into this matter deep enough to find out where they are going to get off. I see my friend Mr. Perry, of Windsor here is paying \$36 a horsepower and is very well satisfied to be left alone at that. But they say, that is too hard on Windsor. They are going to help them out by giving them a bonus in the form of a part of their power cost in addition to the favorable situation that they have of being located directly across from the City of Detroit. We have got to compete with Windsor and I think we ought to get a bonus in some other way for that. Windsor is paying \$36 a horsepower. What should their cost be? I am talking of Windsor, Walkerville and Sarnia—the costs are

all the same for the three of them, \$50 a horsepower—placing this tax of \$2 on power at the Falls would bring their cost up at once to \$38; plus the extra cost of transmission and transformation and so forth we would have a little over \$38—say \$38 even. They would get a concession of \$4. That is, the Power Minister would pay to the Windsor Commission \$4 a horsepower to re-pay to the Provincial Commission for their power. That power was costing them \$34 instead of \$36.

There are some other little items that the Committee does not seem to have considered. The Province has a number of large contracts for power and some of them run for a considerable period of years. Take one of them, one of the first the Commission made, of any size, the Union Carbide Company, for 16,000 horsepower, and that has about five or six years yet to run. A tax of \$2 per horsepower added to water would simply mean that the Ontario Power Company would have to pay \$2 more. The Commission wouldn't have to pay the Ontario Power Company any more. The customer, the Union Carbide Company, wouldn't pay the Commission any more and the \$2 would come out of the Ontario Power Company which is owned by the Provincial Commission, and there in one customer, would be a loss or a reduction in profit or an added loss of \$32,000 a year.

Now you can take all of those other big power users that the Commission serves and you can readily see you are going to boost your cost of power a dollar or more. There is 60,000 horsepower that is sold by the Com-

mission to the Lockport and Ontario Power Company, and there would be \$120,000 more which the Ontario Power Company would have to pay out and would not get any more revenue for.

The Ontario Power Company belongs to the Commission. There is \$120,000 more, and it is the same way right down the line. At Windsor there is the salt works with which the Commission has a ten year contract. That is the way it would affect the Commission's costs. How would it affect the municipality? Some of us have only got a year to year contract and if our costs go up we will say, let the consumer bear it, and in a great many cases the consumer can bear it.

But to come to the case of St. Catharines, when we started our system we bought the distribution system of the Ontario Power Company inside of the city, with fourteen consumers. Some of them had contracts running forty years at a fixed rate. We can't change those contracts. The Hydro-Electric Power Commission of Ontario, representing the Province, bought out the local system of the Ontario Power Company in St. Catharines and sold it to the City of St. Catharines with a contract for power running thirty years. Now, we have had some variations in our power contract, largely with our own consent, but here the Province is going to saddle on us an added \$2.00 in our cost of power and are not going to give us any relief from these big power consumers, who are all going to cost us \$2 a horsepower per year.

St. Catharines has got to slide that onto our smaller customers, so that we are going to pile up our costs on our labor and retired farmers and gentlemen living in the city. We are going to pile it up pretty high, because we have got to carry on that load the entire cost of that \$2.00 for horsepower. Hamilton is the same way, ten year contracts; all of the larger places have got ten year contracts because no manufacturing plant will go in and invest a large amount of capital without having a guarantee and knowing what they are going to do, where they are going to get the power and what it is going to cost them. We have handicaps enough in this Province the way things have been going. Are we going to stand for this without putting up some fight? Toronto is taking 60,000 horsepower and will pay her \$120,000 a year to help the rural sections. Yet I wonder how many hundreds of thousands of dollars a year Toronto has to pay, because it is not spread over the country, for eggs at \$1.00 a dozen, while out on the farms you can get them for 50 and 60 cents. If we are going to equalize the cost of power let us equalize the cost of eggs. There is just as much reason in one as there is in the other. If Windsor has got a favorable location for new industries let us give Listowel a bonus for that, so that they can do something to get more industries up there. We have got gas down our way. Some of the other people haven't got gas. Shouldn't the Province pipe that natural gas and spread it out evenly over the province at an even cost? Where is it going to lead to? There is no end.

Mr. J. E. B. PHELPS, Sarnia: Mr Chairman and Gentlemen, Mr. Yates doesn't seem satisfied to stay down in the Niagara Peninsula and talk about his own town but must try to bring in Sarnia in his argument. I thank him for the advertisement. I wish to thank him also on behalf of Mr. Perry and Mr. McHenry. It is true we pay \$36 a horsepower a year in Sarnia for power. We are well satisfied to pay it, as Mr. Yates says, although we don't always pay when we ought to pay. The Commission may tell you that. However, I am not in favor of this \$2.00 charge being placed on power. As Mr. Yates brought out it probably will cost Sarnia \$34. To be candid with you we expect to get it for less than that. In fact I wouldn't want to go into that kind of proposition at all because some day we are going to get it for less than that, probably \$20 or \$22 if they leave us alone.

I think, gentlemen, Mr. I. B. Lucas' remarks were very timely in the address which he gave us last night. There is a lot of fellows going around the country shooting the bull, not only in our country but all over the world. The whole world is upset. I think his remarks will help us to study it and show us that the world is not going to the dogs at all and things are going to be all right.

Mr. Yates mentioned the men that composed this committee and got up this report. I didn't happen to know the occupation of the gentlemen. He gave it to us. I was glad to find out because I was wondering what the standing was of the men that got this report up, and what they knew about it. Apparently by what he said I

don't think they know very much about it. For instance, I have been suffering for the last four weeks from neuritis, and to be candid with you I didn't go to a horse doctor to get some medicine, I went to the best physician in the City of Sarnia as far as I know, and I am taking it, and I have the bottle in my pocket. Between the medicine that the doctor has given me and the Bransom Violet Ray Machine I am getting there. Thanks to the Hydro for giving me the Violet Ray. But what I want to say, gentlemen, is this, in this report they say something about it being a vicious system, it is giving the fellows a bonus in the most vicious form. They say further that these manufacturers in the cities can well afford to pay this extra \$2. I own a house and lot in Sarnia, and unfortunately on a paved street. I think I have eight rooms in the house, and I pay more taxes on that house than some of the farmers do on their 150 or 200 acres of land. I am not complaining about it and I am not asking the farmers to come in and pay my taxes. I think we ought to get down to basic facts and say every industry, no matter whether it is agriculture or what it is, ought to stand on its own feet. That is what we are doing in this Hydro-Electric. We are standing on our own feet and I don't think after the municipalities have made a success of it that these fellows should come along and put their finger in the pie unless they are willing to put up a fair share of the cost.

In the report the writer also refers you to the lumber industry and says that the Government collects money

from these lumbermen. But you must recollect the lumberman goes out into the bush and what does he do? He chops down a tree. He destroys something. The Government comes along and says, we want so much money because you are destroying this tree. You are not going to grow another one. On the other hand here is water going over the Niagara Falls. It is doing no good running over there, and we are using it. If there is anything we want in our country to-day it is to back up industries that are producing something for our country and not destroying. I don't think the point is well taken. There is no comparison at all, to take \$2 for horsepower from these development plants and compare it to the lumber industry. There is nothing to it at all. Those men are destroying the forests and not putting anything back, only paying a few dollars to the Government when they happen to collect.

I think, gentlemen, there are some others to follow me in the discussion, but to be candid I think if there is one criticism that can be made of the Hydro Commission it is the fact that we are not educating the people in our province to know what a great undertaking the Hydro is. Sir Adam Beck as you all know has put up some of the greatest scraps for this municipally owned institution, and he has been winning out right along. The greatest thing he ever put over was this purchase of the McKenzie-Mann interests, but I want to tell you that the greatest fight of all if we don't watch ourselves is going to be to keep our Hydro out of politics. The moment you let the Ontario Government

appoint a Power Minister and get the Hydro up at Queen's Park you can sound the death knell of the Hydro and I don't want to have anything to do with it.

MR. E. V. BUCHANAN, London: Mr. Chairman and Gentlemen, I had some diffidence about the advisability of talking on this question at all. It is perhaps not quite in place for us, as employees of the Hydro Commission and the local commissions to discuss this matter of policy that is before the House, but if we confine our discussion to logical reasons I don't see why we shouldn't put it on that basis, but to keep away from expressing general opinions.

I don't think Mr. Yates went far enough when he instanced the case of Windsor where the power is costing \$36 and it would be brought down to \$34 by this method. Another city where power is to-day costing \$29 would have to be increased to help to reduce the power in Windsor. If the other scheme is adopted of paying 80 per cent. of the low tension distribution system you would have to increase the municipalities which are now paying less than \$30, a great deal. This multiplies itself and goes on until you get what? A flat rate, that is the logical conclusion. This, gentlemen, is a camouflaged flat rate, there is nothing else to it as far as I see, and you are getting away from the basic principle of the whole Hydro-Electric system. The basic principle is power at cost. Now, just as soon as you get away from that then you might as well call it a flat rate because that is what it is going to be. There isn't any question about that in my mind. I haven't had

any time to look at this paper but I note on page 4, "Your Committee also believes that the Hydro-Electric System should pay in taxation to this Province in the same proportion as would a private individual upon the same property in the different municipalities." Now, I don't know of any taxes that any business pays directly to the Provincial Government. I don't think any business operated in the municipalities pays direct taxes to the Provincial Government. They pay taxes to the Dominion Government, on excess profits and income tax. Perhaps they refer there to the taxing of the Hydro-Electric Systems in municipalities through municipal taxation. If that is the case, what are taxes? Taxes are costs paid to the Government, any Government, municipal, provincial or Dominion, for some service rendered. You pay in your municipal tax bill for police, for education, for streets, and in some municipalities I believe you pay in your taxes for water. There is no straight water rate; you simply pay so many mills in the dollar for the water supply. You might even pay in the same way for the Hydro-Electric supply. But the point is this, when you pay directly in your taxes for water or for Hydro the bill that you pay for Hydro to the municipality it just as much a tax as your police tax; it is a tax and goes to the Government for service rendered. Now, what are you going to do? You are going to tax a tax, you are going to tax your Hydro bills. Why not tax the Police Department a proportionate cost of all the other departments in the city? Then again there is not much sense to it when you look at it in

this way, that if every rate payer in the city is using Hydro you are only asking him to hand money round in a circle. If you tax him 4 cents a month on his light bill, it is just so much that he has to pay less in his tax bill, so there is not very much sense in taxing the local system, because the service is being rendered at cost, and it is standing on its own feet.

Further on in the report it is stated that where the Provincial Treasury receives large amounts of net revenue from the Public Works Department, motor vehicles, forests and mines, there is a deficit in connection with the Hydro-Electric Power Department. I don't think there ought to be. I think there should be enough paid to the Provincial Treasury to cover any expense they may have in connection with Hydro-Electric development, but in looking over the list, here, they show that \$19,700 is paid as rentals for power and they say that it is not nearly enough to cover the expense, but I note here opposite the Abitibi Power Company, that there is 22,000 horsepower rental at the rate of 50 cents per horsepower and they do not collect it. There is \$11,000 right there. There are a whole lot of other blank spaces. I believe Abitibi is developing a whole lot more than 22,000 horsepower, I believe it is somewhere in the neighborhood of 40,000 horsepower. Why don't they collect it? I don't know. I think that it is quite justified that the Government should be paid for the expense that they have in connection with Hydro-Electric development and they should secure that money from rentals of water

power, but the whole point is that you have here, as they call it, a more equitable system of distribution of Hydro-Electric Power and a more uniform price. It is not a uniform rate, it is a flat rate and that is what it is going to resolve itself into. As the cost of power goes up and up the whole tumbles down.

MR. M. J. MCHENRY, Walkerville: Mr. President and Gentlemen: I had the pleasure of listening to the Hon. Mr. Drury at noon to-day, and I must say I have been very much impressed with Mr. Drury's ability as a speaker. I believe, to a certain extent at least, Mr. Drury is correct in advocating a policy which will mean the distribution of electric light and power to the rural population. There is no doubt that it is essential, insofar as practicable, that the rural population be supplied. There is one feature in connection with it, however, which appeals to me, and that is the fact that it is or may be impossible. I wouldn't say off-hand that it is impossible, it may not be possible to carry this to the ultimate conclusion of the Hon. Mr. Drury from a practical standpoint. There is a possibility that the ultimate cost involved would make the scheme prohibitive. It is evident that the policy advocated is to see that all of the agricultural interests are taken care of. There are certain sections of the Province where I feel that this could not be done without running into expenditures which would be altogether unreasonable and uneconomical. The whole question then resolves itself into the question of how far are you going to go with this policy before you run into the posi-

tion where the expenditure involved makes the whole proposition a burden on the Province generally.

Referring to the report of the Legislative Committee, I feel that this report has been prepared and presented without going into the matter deep enough. It appears to me that this report is more or less superficial. The question involved is too great to be considered in the manner that it has been taken up, and I feel that before any action should be taken on this proposition considerably more detailed information and data should be collected and considered.

With regard to the report itself, there are one or two items I would like to mention. On page four of the report, the Committee recommends the taxing of Hydro-Electric systems from which the Province would derive a revenue of approximately \$500,000 a year. Mr. Buchanan spoke of this this morning, and I believe it would be an unwise arrangement.

In the next paragraph they say exemption from taxation is a system of bonusing in its most vicious form. I think that the recommendation of the Committee, that a surcharge be made on certain sections of the Province and certain municipalities is nothing more nor less than a system of bonusing possibly in its most vicious form also.

On page six they take up the question of an attempted comparison between revenue derived from the timber industry and that of power. I do not think this is at all feasible, as the two are on absolutely different bases. It is necessary that the Gov-

ernment should derive a large amount of revenue from the timber industry, which is destructive, because it is necessary that the Province take some steps in the near future to re-forest certain sections of the Province, if they have not already done so. The development of power is not destructive, but constructive, and consequently will add to the assets of the Province instead of being a liability.

There are a few things in the report which are misleading, and it is very difficult to say in some cases exactly what the Committee had in mind. There is more than one interpretation which may be put on it. For instance, on page eleven, the last paragraph is: "It should be borne in mind that under the system of assistance suggested in this report, the rental of \$2 would not add to the cost of power to any municipality paying \$30 per horsepower, and the Committee submits that the industries of this country can well afford to pay such rental. The Dominion of Canada has water-power to the extent of about 19,000,000 horsepower, and of this there has been developed 2,300,000 horsepower, 85 per cent. of which is in Ontario and Quebec. The British Isles, which are among the chief industrial exporters of the world, have less than 1,000,000 horsepower. With the price of coal as it is at present, and upon which many countries have to depend for power, the rates under our own Hydro-Electric system are cheap in comparison with nearly every other country in the world. We have reason to believe that in cities as close as Buffalo \$60 is now paid for power generated in Ontario."

The question arises in my mind immediately that that is open to two interpretations, one interpretation is the fact that the municipalities paying \$30 or more per year for power would not have to pay the additional \$2 for power. Another interpretation is the one that this would not add to the cost to them because it would be refunded by the Government.

On page twelve they make the statement: "From Canada in the fiscal year ending March 31, 1919, there were exported farm products to the value of \$553,000,000, while the export of manufactured articles during the same period amounted to \$249,000,000, or less than one-half that of farm products." I think that statement has no business in this report for the simple reason that it does not apply to the Province of Ontario which is under consideration. They have taken the aggregate exported farm products for the Dominion of Canada which includes the whole of the North West, the bulk of the agricultural industry of the Dominion, and they have balanced that against the aggregate of manufactured products which is mainly in the Eastern Provinces, Ontario and Quebec. It would seem to me, therefore, that considerably more information should be obtained before any action along any such lines as suggested in this report is taken. I do not think the matter has been sufficiently investigated before presenting the report.

MR. R. H. STARR, Orillia: Gentlemen, as I mentioned yesterday, in Orillia we are at present cursed with the flat rate. It looks as if some more of you gentlemen are going to have

the same curse if this thing goes through.

This would mean roughly about \$10,000 a year to Orillia. Orillia now pays only \$800, which we think is quite sufficient. We don't think it right that Orillia which, during 1919 had the foresight to put in a lot of money, to develop this water-power situated about 20 miles away, should be so taxed. It was one of the first municipal developments undertaken, if not the first. I can't see why if this goes through we should not go back and say: "Here, we want freight rates so adjusted that coal will be just as cheap to us in Orillia as at Niagara Falls." I think it is a most unfair report or charge to make the parties who are benefited from their locality by cheap power, help to pay some of these other towns. Suppose Tottenham and Beaverton, which are on the extreme south end of the system, do get a little cheaper power, is it going to build them up industrially? I don't think so. As Mr. Yates mentioned this morning, I think if this goes through we have got to have a reduction in the price of eggs.

MR. E. V. BUCHANAN, London: Mr. Chairman, it occurs to me from listening to Mr. Drury at noon to-day, that the Government is determined to put through some sort of legislation of this kind. There doesn't seem to be any doubt about it. If they can get a majority in the House, they are going to adopt some sort of legislation. Mr. Drury said distinctly, he thought the tax of \$2 a horsepower was too great. But so far in this meeting all the criticism has been destructive. We have demonstrated

clearly that the scheme set forth here is quite impracticable. Now could we offer or is it in place for us here to offer any constructive criticism? That is just a suggestion I would like to make. I haven't much to suggest myself except in line with what I believe the Hydro-Electric Power Commission has already approved of, that some sort of bonus should be given towards the construction of rural lines. But the cost of power outside of that should not be hampered with, of that should not be interfered with, the cost of power it automatically becomes a flat rate, it can't help it.

MR. J. G. JACKSON, Chatham: I would like to make some suggestions. I think the rural lines in the past have been unduly critisized, but a sufficiently good service in the rural districts could be furnished by running only a single phase line, in some cases one wire or two wires, with one side grounded. All the rural services could be limited to single phase services. The man who is using power would have to pay more money for his motors, but that is up to him. He wouldn't ask us to pay for his motors. At least, I don't think he would. Consequently the cost of the line would be much less than it is now, and the cost of his power would be correspondingly reduced.

MR. MCHENRY: I understand the Ontario Commission has effected during the last year a certain amount of legislation, and has also considered certain plans with regard to rural distribution, and, if possible, I would like to hear something from Mr. Jeffery as to what work they have done in

that way. It may be of use to us in this particular case.

MR. R. T. JEFFERY: Up to 1920, power was supplied by the Commission to rural districts under the Rural Act of 1911. According to that Act, each Township was considered as a unit in connection with the matter of power supply, and before an individual user could obtain power, the Township must sign a contract with the Commission, and the user in turn must sign a contract with the Township, which scheme was quite satisfactory when only a few users were to be supplied adjacent to existing lines, or stations, but, when a large district, comprising an entire Township, or part of several Townships, is to be considered, this Legislation has proved to be unsatisfactory, except in certain cases where there happened to be a suitable sub-station, or low tension line located at such a point in the Township under consideration that power could be supplied from that station economically to serve the entire Township.

You are well aware that the area of the various Townships in the Province vary over wide ranges, and the boundaries of these Townships are very irregular, as the load centres, or municipalities throughout the Province, are located without any reference whatever to Township boundary lines. You will readily see that the stations and lines constructed to supply power to the urban municipalities in the Province are not, as a rule, located so as they can be used to supply power to Townships economically, each Township being considered as a separate unit.

At the last session of the Legislature, a new Act was passed by which the Commission was given power to sub-divide the Province into rural power districts, the boundaries of which districts would be determined by the area which could be served economically from existing power centres, or low tension transmission lines, or from new power centres that might be formed for this purpose, and the rates at which power would be supplied for the same class of service or use to all residents within each district would be the same. The boundaries of these rural power districts would have no reference whatever to Township boundaries; each district to be considered as a unit in itself.

Before the boundaries of proposed rural power districts can be fixed, it is necessary to make a careful survey of the power requirements of all residents in the district to be served, and during the past summer, the Commission had five men engaged continuously making careful rural surveys in many parts of the Province, visiting each farm in the district surveyed, and, where possible, discussing the matter with the farmer himself in order to be able to make a fairly accurate estimate of the power requirements of each farm. The Reeve of the Township, the Township Clerk and the Treasurer were also interviewed and information obtained regarding the assessed value of each farm, the name of the owner, and other information of importance, in order to arrive at a fairly accurate estimate of the power requirements for each farm; that is, the kind of farming, the character of the land,

etc. On the basis of this detailed information, a report was made for each district surveyed, and, in this report, the farmers of each district were divided into three classes, namely,—“Good,” “Fair” and “Poor.” The class marked “Good” were those that our engineer considered would be sure to take power, provided the rate was reasonable. The class marked “Fair” were the doubtful ones, who might take power after the lines were constructed. The class marked “Poor” were the farms on which it was considered that power would not be used.

During the past season, our engineers have made a detailed survey of all or part of approximately seventy-one Townships, in the manner I have just described. On the basis of the information, which we have obtained in making these surveys, we are now preparing estimates of the cost of supplying certain districts, in the surveyed areas, the idea being to divide each Township, or each group of Townships, into districts, with, as I have already stated, boundaries which are fixed arbitrarily, based on the economic distribution of power from existing power centres or lines, or from power centres or lines that may be constructed later.

The rates at which the Commission will be able to supply power to rural districts will, I believe, be considerably higher than many farmers have been led to believe they can afford to pay for this service; that is, of course, unassisted by a grant from the Provincial Government in the way of paying part of the capital cost of constructing lines to serve them. However the whole scheme will be proved

out very soon, as we have already prepared estimates in a great many districts and propose to start a series of public meetings, commencing with those districts that first made application and are most insistent in their demands for power, and, at these meetings, our engineers will explain to the farmers, the Commission's scheme of supplying power to the rural districts in the Province, also, the cost of supplying same.

It has been suggested, in many cases by the farmers themselves, that they would be willing to assist in building the lines, as there are certain slack seasons during each year when the farmer's work is not very pressing, and he could quite easily spend several days or weeks during the slack seasons in helping to construct power lines, and, I believe, farmers will be willing to co-operate in this way, if it is explained to them that it is to their benefit financially to do so.

We are preparing estimates on three different bases; first, on a basis of the Commission building all of the lines to supply the district; that is, the Commission would take a gang of men into the district and build all of the lines without any assistance whatever from the farmers; the second scheme would be for the farmer to supply a part of the labor and cartage at a certain figure; that is, the farmers being employed by the Commission, at say 30c. per hour, or some other reasonable rate, depending on the value of labor in the district in which the lines are being constructed; and, the third scheme, on a basis of the farmers in each district doing the work of building lines in that district free-of-

charge, the Commission supplying a lineman and working superintendent, who would have charge of the work, and show the farmers how to build the lines; that is, the farmers in the district would form a "bee," as it were, to haul poles and dig holes, erect poles, cross-arms and wires, with the exception of tying-in of the wires, which would be done by the lineman in charge of the work.

On the basis of the last scheme; that is, the farmers supplying free labor and cartage, for the construction of lines in their own districts, I believe, that power could be supplied to many districts at very reasonable rates, and it is just a matter as to whether the farmers, who state that they want power, are willing to help themselves, and, we propose to put it up to them in that light. I believe in a great many cases, the problem of supplying power to rural districts is going to be solved. There are, however, many districts that we know are practically deserts as far as good farms are concerned, in which, of course, we have cases of two or three farmers, or, perhaps more, but to which it would be impossible to supply power at reasonable rates on account of the small number of consumers per mile of line that must be constructed to serve them. It will, therefore, be almost impossible for the Commission to supply power at reasonable rates to these farms, or at rates which these farmers can afford to pay, but, there are many districts to which it will be possible to supply power at reasonable rates if the farmer is willing to help himself, and assist in constructing the lines during slack seasons.

MINUTES OF CONVENTION

THURSDAY, JANUARY 27.

The Convention was called to order at 2.30 p.m. in Room C.26, Chemistry and Mining Building, University of Toronto, by the President, Mr. O. H. Scott.

The first duty of the President was to name three delegates, a nominating committee from the Chairman of standing committees present. There were but two such Chairmen present. Moved by Mr. M. J. McHenry, Seconded by Mr. H. F. Shearer:

That the President be empowered to appoint a third member to the nominating committee from the membership at large.—*Carried*

Messrs. V. S. McIntyre, A. T. Hicks and R. H. Martindale were named as a committee to bring in nominations for the various offices.

The Auditors' report was presented which showed a balance on hand, Dec. 31, 1920, of \$799.35.

Moved by Mr. E. I. Sifton, Seconded by Mr. J. C. Burns:

That the report of the Auditors be adopted.—*Carried*.

The President then gave a short address reviewing the work that had been done by the Association, and suggesting other work to be taken up by the members.

Announcement was made of an invitation to attend a luncheon of the Electric Club on the following day. A letter from the Toronto section of the American Institute of Electrical Engineers was read which also invited the delegates to attend its meeting on the evening of the next day.

Moved by Mr. P. B. Yates,

Seconded by Mr. E. M. Ashworth:

That an honorarium to the Secretary be granted to be fifty per cent. greater than that previously given.—*Carried*.

Mr. E. I. Sifton referred to reports in the newspapers giving an account of the report presented to the Ontario Government on "A more equitable system of distribution of Hydro-Electric Power and a more uniform price" and suggested this as a subject for discussion. After outlining the report it was agreed that it would be taken up on the following day.

The nominating committee, having presented its report the election of officers for the coming year was proceeded with.

The following were elected:—

President—Mr. M. J. McHenry.

Vice-President—Mr. R. H. Martin-dale.

Secretary—Mr. S. R. A. Clement.

Treasurer—Mr. G. J. Mickler.

District Vice-Presidents:—

Niagara District—Mr. J. G. Archibald.

Central District—Mr. A. T. Hicks.

Eastern District—Mr. H. F. Shearer.

Northeren District—Mr. R. H. Staford.

Georgian Bay District—Mr. E. J. Stapleton.

Convention Committee:—

Messrs. P. B. Yates (Chairman), E. I. Sifton, J. J. Jeffery, Geo. D. Leacock and J. W. Bayliss.

Papers Committee:—

Messrs. H. H. Couzens (Chairman) L. G. Ireland, J. G. Jackson, R. T. Jeffery and C. H. Hopper.

Regulations and Standard Committee:
Messrs. R. H. Starr (Chairman),
T. C. James, H. O. Fisk, G. Hall,
and W. P. Dobson.

Auditors:—

Messrs. H. P. L. Hillman and W.
G. Pierdon.

During the election of officers the Convention was thrown open for general discussion of questions brought up by the members.

Mr. A. T. Hicks presented a report from the Regulations and Standards Committee re the formation of a Canadian National Electrical Code.

Moved by Mr. A. T. Hicks,

Seconded by Mr. E. V. Buchanan:

That the report of the Regulations and Standards Committee be adopted.
—*Carried.*

Mr. C. E. Schwenger, Engineer of Distribution, Toronto Hydro-Electric System, read a paper entitled "The Economical Handling of Range Loads on Distribution Systems."

Discussion on this paper was by Messrs. R. H. Starr, A. W. J. Stewart, E. V. Buchanan, H. C. Powell, P. B. Yates, and E. M. Ashworth.

The Session adjourned at 5.30 o'clock p.m. At 6.00 o'clock the delegates met at the Hotel Carls-Rite where an excellent dinner was served. Hon. I. B. Lucas, Commissioner, Hydro-Electric Power Commission of Ontario, was the guest of the Association at this dinner, who gave a very timely and instructive address. Mr. E. C. Settell, Secretary to Sir Adam Beck, introduced Mr. Lucas to the members in a few well chosen words. The musical programme was under the direction of Mr. Jules Brazil. Friday, January 28.

THE SECOND SESSION OF THE CONVENTION WAS CALLED TO ORDER
AT 9.30 A.M.

Messrs. M. V. Sauer, Hydraulic Engineer and E. T. J. Brandon, Electrical Engineer, both of the Hydro-Electric Power Commission of Ontario gave talks on the Chippawa-Queenston development which were illustrated with lantern slides and moving pictures. Their talks were interesting in the extreme and received with hearty applause from those present.

The discussion on the report of the Legislative Committee on "A more Equitable System of distribution of Hydro-Electric power and a more uniform price" was continued. This discussion was taken up by Messrs. R. T. Jeffery, P. B. Yates, J. E. B. Phelps and E. V. Buchanan.

The meeting adjourned at 12 o'clock noon.

AFTERNOON SESSION.

The third session of the Convention was called to order at 2.30 o'clock p.m.

Mr. W. P. Dobson, Laboratory Engineer, Hydro-Electric Power Commission of Ontario, read a paper on "The Testing and Approval of Electrical Appliances in Ontario."

A letter from Mr. F. A. Cambridge, City Electrician of the City of Winnipeg re "Electrical Fatalities in Bathrooms" was read.

Discussion following Mr. Dobson's paper was by Messrs. G. B. Muldaur, E. V. Buchanan, C. J. Leacock, J. F. S. Madden, T. R. Goldsmith, M. J. McHenry, H. Doty, J. J. Heeg, S. L. B. Lines, V. B. Coleman, J. G. Archibald and R. H. Martindale.

Discussion on the report to the Legislature was again taken up. Those speaking further on this subject were, Messrs. M. J. McHenry, R. H. Starr, E. V. Buchanan, J. G. Jackson, Geo. D. Leacock, R. T. Jeffery and J. C. Burns.

Moved by Mr. V. B. Coleman,

Seconded by Mr. J. G. Archibald:

That this Association appoint a committee to send a verbatim report of the discussion on the matter of the report of the committee of the Legislative Assembly on "A more Equitable System of Distribution of Hydro-Electric Power and a more Uniform Price" to the Ontario Municipal Electrical Association for their assistance in dealing with this report.—*Carried.*

The meeting adjourned at 5.00 o'clock p.m.

SATURDAY, JANUARY 29.

On this morning and also on the morning of Thursday, the 27th, the laboratories of the Hydro-Electric Power Commission of Ontario were open to the delegates when they were the guests of the Commission.

The register shows a total attendance at the Convention of 156, made up as follows:—

Class A delegates	53
Class B delegates	15
Commercial delegates	56
Associates	24
Visitors	8

156

The attendance at the Association dinner was 178.



Attractive window display of the Picton Hydro Store



Present Day Illumination Standards*

Geo. C. Cousins

Illumination Laboratory, Hydro-Electric Power Commission of Ontario

ARTIFICIAL illumination is one of the products of civilization that permeates every branch of our activities and upon the success of its application depends, to a very large extent, the success of the activities carried on by its aid, especially in industry and commerce.

The high intensity industrial illumination of the present day is in reality

a by-product of the late world war. Previous to this, artificial lighting was considered very much as a sort of crutch to assist industry over the dark periods of the day when work would otherwise have ceased, out of sheer necessity. The economic value of illumination as a strong factor in production was not given serious consideration. The requirements of the war placed the most urgent demand upon industry that taxed its capacities to the utmost with the result that night work was necessary and the short-comings of artificial illumination were keenly felt. This necessity furnished illuminating engineers with a more effective weapon, than any which had previously been available, with which to attack the problem of rendering night work really productive and the results obtained are causing industrial managers to change their attitudes toward artificial lighting and they are now looking upon it as an asset instead of as a liability.

In planning the lay-out of machinery in factories the relative importance of daylight and artificial light

*A paper presented at the general professional meeting of the Engineering Institute of Canada, Toronto, Feb. 2, 1921.

PRESENT DAY ILLUMINATION STANDARDS REFERENCES.

- 1—Ward Harrison, *Effective Lighting Factories*.
- 2—W. Durgin, *Productive Intensities* Trans. I. E. S., November 20, 1917; Elec. Rev. (U. S.) 1919, P. 449.
- 3—R. E. Simpson, *High Cost of Poor Lighting*, I. E. S. Conv., October, 1920.
- 4—Fercee & Rand, *Efficiency of the Eye*, etc. Trans. I. E. S., August 30, 1915.
- 5—J. Daniels, *Dept. Store Illumination*, I. E. S. Conv., October, 1920.
- 6—Fercee & Rand, *Effect of Intensity on The Eye*, I. E. S. Conv., October, 1920.

is frequently not given sufficient study with the result that machines are placed so as to utilize daylight under the best conditions. This arrangement often complicates the utilization of artificial light to the best advantage. Daylight has usually been considered satisfactory and has been used as a sort of reference standard in the absence of real data on the actual conditions. Surveys of daylight illumination in factories have revealed the fact that in many plants the natural illumination is inferior to good artificial lighting. The following is a typical example: A machine shop is built with practically continuous window area on south, west and north walls. On a clear cloudless morning measurements of intensities

at the benches near the windows on the west side showed over 50 foot candles (ft-c) while about 30 feet from the windows the intensities at the work points of machine tools ranged from 3 to 14 feet. C. In some cases artificial light was used to supplement the daylight. The shop under consideration was on the second floor of the building and there were no high buildings within several hundred feet and a clear sky exposure is obtained on all sides. This is a very favorable condition. Where buildings are grouped together so that the sky is obscured the conditions would be very much worse. A more extended study¹ of daylight intensities in 18 factories showed average intensities ranging from 1.5 to 10 ft. C. for lower



Figure 1—Typical example of present practices. Daylight intensities on dull day are from 30 to 3 ft. c. Artificial light intensity 7 ft. c.

grades of work and 4 to 18 for finer grades. These results tend to show that daylight illumination in factories is not as good as is ordinarily supposed to be the case and that the distribution of daylight is far inferior to that of reasonably good artificial lighting. As a result of the knowledge of these conditions it has been proved that artificial lighting can be economically produced that is superior to daylight (Fig. 1,) in both average intensity and distribution and that when the lighting system and the machinery or work spaces are properly co-ordinated the resulting illumination will have the greatest all-day effectiveness and manufacturing can be maintained on a really productive basis throughout the entire day.

For many years the conviction of illuminating engineers has been that factory output could be increased by the use of high intensities of illumination but the putting of this opinion to the test was a difficult problem and it required some strong action to break the ice of opposition.

The problem was attacked in a rather novel manner by the Commonwealth Edison Co. of Chicago. Their engineers approached a number of manufacturers, at whose plants accurate cost records were kept, with the proposal to install trial lighting systems to produce 3 times the intensities previously recommended for the various classes of work. Records of cost and output were to be kept for a month under the existing lighting systems, then for a month under the new and finally a reversion to the old systems for another month. This was expected to furnish reliable data

on the unit cost of output. The results were so gratifying that all of the trial systems were retained as permanent and in some cases the manufacturers would not permit a reversion to the old systems, realizing that it would mean financial loss. Some of the effects of the high intensities were that the increase in production was from 10 to 20% with a maximum cost increase of 5.5% of the payroll. In one case the production was increased 15% with no increase in the cost. The increased economy is due to more work being turned out with a decrease in the amount of spoiled and defective work. The indirect beneficial results to the workers in the form of more cheerful surroundings, cleaner shops, less eye strain and fewer accidents react to the benefits of the manufacturer in keeping the working force in a more efficient and contented mood.

A very important phase of the effects of high intensity is its effect on the accident rate. About 10 years ago approximately 24% of industrial accidents³ were caused by poor lighting and by improving the lighting conditions this percentage has been reduced to about 15%. The economic loss caused by these accidents amounts to approximately \$300,000,000 per year in the United States, which is more than the yearly lighting bill. A graphic illustration of the relation of accidents to the use of artificial light is shown in Fig. 2. In the B curve the portions of the curve showing less than 12 hours of darkness are not relatively important and lines are drawn along the 12 hour obscissa to connect with the curve showing more

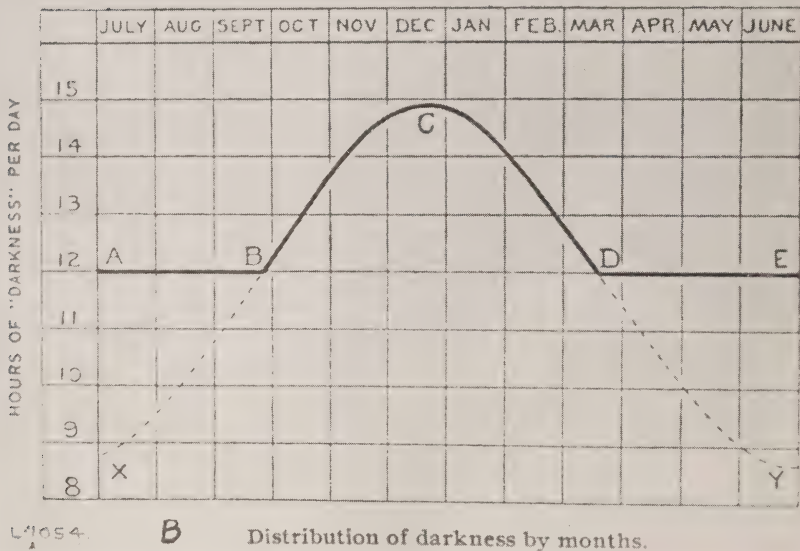
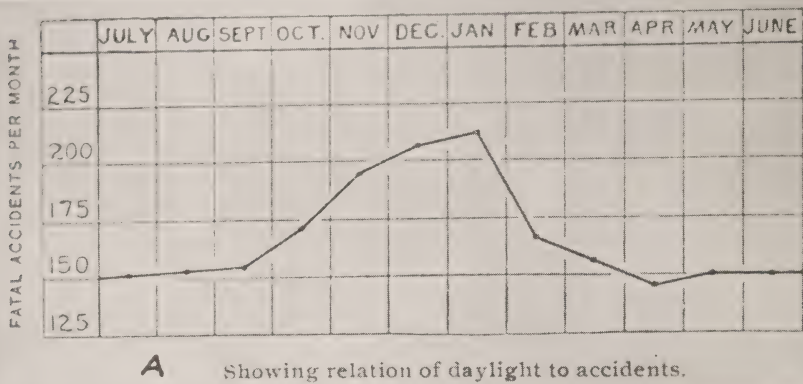


Figure 2

than 12 hours of darkness. The resulting curve thus formed has a striking resemblance to the curve showing the relation of daylight to accidents.

The relative importance of daylight and artificial light may be estimated from the fact that artificial lighting is used on an average of about 5 hours per day throughout the year. This is roughly about 50% of the

working day and in view of this the importance of giving proper weight to artificial lighting is evident. When plants are operated at night the balance is overwhelmingly in favor of artificial light. Fig. 3 shows the number of hours per day during which all the lamps of a factory were used in January and June.

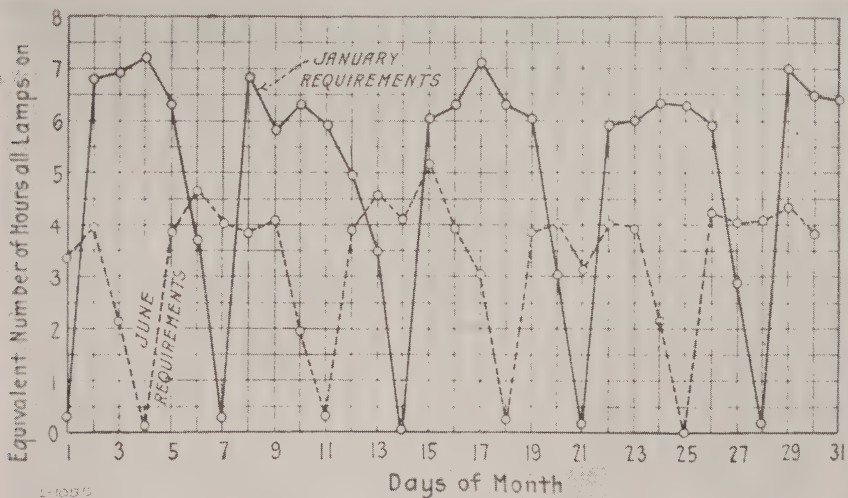
Fig 4 shows the intensities recom-

mended for various classes of work in 1916. A reference to a few of these might be interesting for the sake of comparison. Machine tools were listed as requiring from 2 to 6 ft. C., rough manufacturing 1.25 to 3, fine manufacturing 3.5-6, special cases of fine work 10 to 15, drafting 7. Compare these with some of the recent installations; for an aluminum working plant 14 ft. C., a drawn steel factory 15 to 16 ft. C., manufacturing automobile springs 21 to 22, ordinary machine shop work 10 to 11 and punch presses 6 to 10. These cases do not require particularly fine work and yet the intensities are equal to or greater than daylight intensities in many factories.

As far as can be learned all the installations of high intensities have resulted in economy and are considered good investments. How far high intensity can be carried before the limit

of economy is reached is problematical but that limit has not been reached yet. It appears evident, however, that as intensities are increased the increase in economy will be by smaller increments and that the gain resulting from an increase in intensity of from 10 to 15 ft. C. would not be as great as it would from 5 to 10.

Considerable headway is being made in the elimination of drop cords. In some cases workers have clung so tenaciously to these that their removal has resulted in mutiny. In some operations they are indispensable and to provide for such contingencies in up-to-date plants they are kept in tool check rooms and supplied the same as special tools and are returned when the operation requiring them is completed. Experience has proved that there are very few industries that cannot be lighted quite satisfactorily by overhead units. Drop cords are



NUMBER OF HOURS PER DAY DURING WHICH ALL LAMPS IN FACTORY SECTION WERE IN USE IN JANUARY AND JUNE

Figure 3

relics of the early days when carbon lamps were the only suitable electric lamps for interior lighting and should find no place in modern installations of high powered lamps, in suitably selected and placed reflectors except in special cases where overhead lights

sometimes necessary to provide individual lamps for machine tools placed in open bays. In some cases flood lighting units placed close to the ceiling are suitable and for others an adjustable lamp with its reflector is mounted on the end of a pipe arm

INTENSITIES OF ILLUMINATION RECOMMENDED FOR VARIOUS CLASSES OF WORK		Foot-candles	
	Foot-candles		
Bakery.....	2.0-3.0	Packing and shipping:	
Bench work:		Ordinary work.....	2.0-3.0
Rough.....	1.5-5.0	Fine work.....	2.0-5.0
Fine.....	3.5-10.0	Paint shop:	
Box factory.....	2.0-4.0	Coarse work (first coats).....	2.0-3.0
Book binding:		Fine work (finishing).....	4.0-8.0
Cutting, punching, stitching.....	3.0-5.0	Passageways.....	0.25-0.3
Embossing.....	4.0-6.0	Pattern shop (metal).....	4.0-6.0
Folding, assembling, pasting.....	2.0-4.0	Pottery:	
Candy factory.....	2.0-4.0	Grinding.....	1.0-2.0
Canning plants:		Pressing.....	2.0-4.0
Coffee roasting at tables.....	3.0-4.0	Power house:	
Filling tables.....	1.0-1.5	Boiler room ¹	0.8-1.5
Packing tables.....	1.0-2.0	Engine room.....	2.0-3.5
Packing tables (dried fruits).....	1.5-2.5	Preserving plant:	
Preserving cauldrons.....	2.0-2.5	Cleaning.....	2.0-4.0
Pressing tables.....	1.0-1.5	Cooking.....	2.0-3.0
Shipping room.....	1.5-2.5	Printing:	
Cotton mill weaving ²	2.0-4.0	Presses.....	3.0-5.0
Dairy or milk depot.....	2.0-4.0	Type-setters.....	6.0-8.0
Drafting room.....	7.0	Sheet metal shop:	
Electrotyping.....	3.0-6.0	Assembling.....	2.0-4.0
Factory:		Punching.....	3.0-6.0
Assembling.....	4.0-7.0	Shoe shops:	
Drills.....	2.0-4.0	Bench work.....	2.0-5.0
Millers.....	3.0-6.0	Cutting.....	5.0-7.0
Planers.....	3.0-5.0	Silk mill:	
Rough manufacturing.....	1.25-3.0	Finishing.....	3.0-5.0
Fine manufacturing.....	3.5-6.0	Weaving.....	4.0-6.0
Special cases of fine work.....	10.0-15.0	Winding forms.....	2.0-4.0
Forge and blacksmithing:		Stairways.....	0.25-0.5
Ordinary anvil work.....	2.0-4.0	Steel work:	
Machine forging.....	2.0-3.0	Blast furnace (cast house).....	0.3-0.5
Tempering.....	2.0-4.0	Loading yards (inspection).....	0.3-0.5
Tool forging.....	3.0-5.0	Mould, skull cracker and ore yards.....	0.1-0.3
Foundry:		Open hearth floors (soaking pits and cast house).....	0.1-0.3
Bench moulding.....	1.0-3.0	Rolling mills.....	1.0-2.0
Floor moulding.....	1.0-2.0	Stamping and punching sheet metal.....	2.0-5.0
Garment industry:		Stock room.....	0.8-2.0
Light goods.....	5.0	Threading floor of pipe mills.....	1.0-2.0
Dark goods.....	7.0	Transfer and storage bays.....	0.5-1.0
Glove factory:		Unloading yards.....	0.1-0.3
Cutting.....	5.0-6.0	Warehouse.....	0.5-1.6
Sorting.....	6.0-10.0	Stock rooms:	
Hat factory:		Rough materials.....	1.0-1.0
Blocking.....	4.0-6.0	Fine materials.....	2.0-1.0
Forming.....	3.0-5.0	Storage.....	0.25-0.5
Stiffening.....	2.0-4.0	Wire drawing:	
Jewelry manufacturing.....	3.0-5.0	Coarse.....	2.0-4.0
Knitting mill.....	3.0-6.0	Fence machines.....	2.0-3.0
Laundry.....	3.0-5.0	Fine.....	4.0-8.0
Leather working:		Wood working:	
Cutting.....	4.0-6.0	Rough.....	2.0-4.0
Grading.....	6.0-8.0	Fine.....	3.0-5.0
Meat packing:		Woolen mill:	
Cleaning.....	2.0-4.0	Pickup table.....	2.0-4.0
Packing.....	2.0-4.0	Twisting.....	2.0-3.0
Offices.....	3.0	Warping.....	3.0-5.0
		Weaving.....	4.0-6.0

Figure 4

cannot reach the point where work is being done. The practical solution of the elimination of drop cords is the correct placing of lamps relative to the work places or vice-versa. In large plants of mill construction it is

which can be adjusted horizontally through an unthreaded T which can in turn be raised or lowered on the end of a telescoping upright. By this means a substantial construction is provided without the dangers accom-

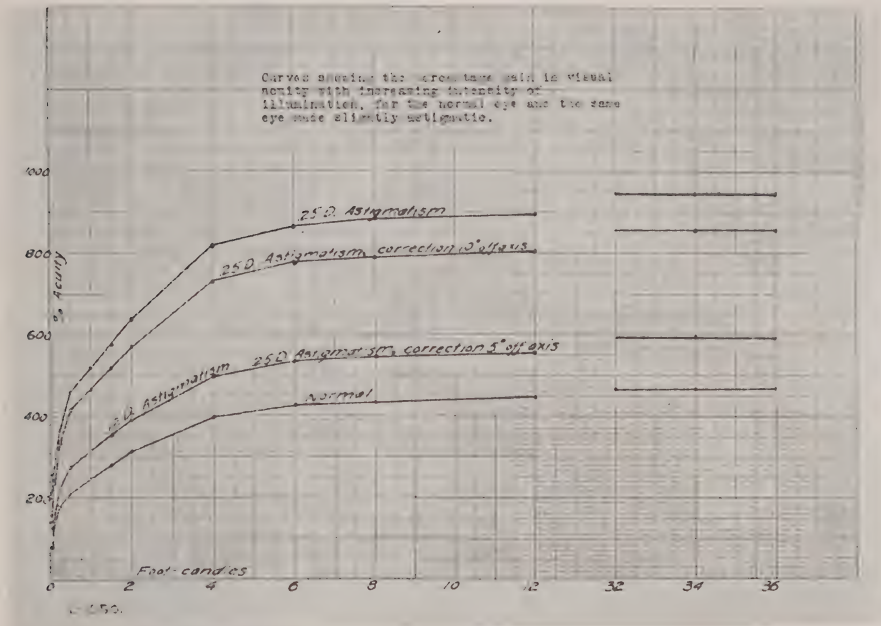


Figure 5

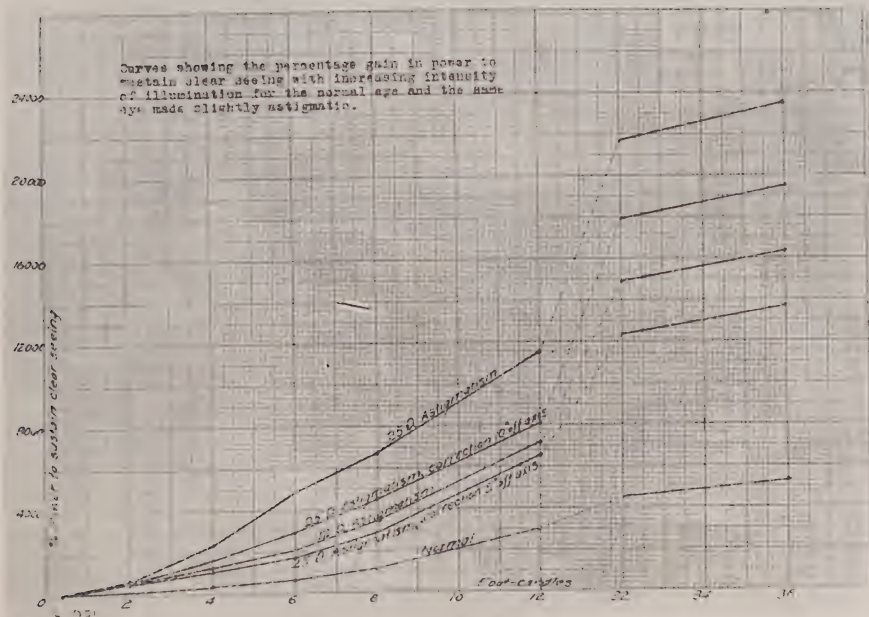


Figure 6

panging exposed insulated wire.

Aside from the strictly productive value of artificial light is the effect of its character on the selection and classification of materials and the detection of defects. The value of the color of the light for these purposes is increasing and many industries are making use of white light, or artificial daylight in certain departments. This is a very broad subject that can only be touched upon in this paper.

A few of the industries requiring color distinction are as follows: paper, flour, paint, sugar, jewelry, tobacco, chemical, textile, color printing and ore refining. There are different ways of producing daylight quality but the most common is by filtering some of the excess red and yellow from the light of gas-filled tungsten or from incandescent gas. A luminous gas lamp is also available which produces the required color directly. The simplest and most commonly used is the gas-filled tungsten lamp with a blue bulb. These are made in three grades or density of color to be used according to the accuracy of color selection required. The 1st is known as C2 and is a compromise between noon sunlight quality and ordinary gas-filled lamp color. Its efficiency is about 69% of that of the C1 lamps or 8-11 L.P.W. Its principal use is for producing a daylight effect where accurate daylight quality is not necessary and efficiency is important. A light of the same color as noon sunlight is produced with a corresponding loss of efficiency by a lamp with a deeper blue bulb than the C2, at 567 L.P.W. This lamp is suitable for all but the most exacting color per-

ception for which a north-skylight lamp is furnished at 2 L.P.W. These color matching effects can also be produced by screens of suitably colored glass fitted to reflectors in which are clear bulb gas-filled lamps. When selecting filters or lamps for any of the above mentioned purposes, it is necessary for the resulting light to have the proper distribution of light throughout its spectrum. Daylight effect can be produced by mixing two or more primary colors but its spectrum might be discontinuous and it is easily possible to select two samples of similar color that appear identical under continuous spectrum white that appear very different under synthetic white.

Colored light, white or otherwise, can be used to show any color in contrast to any other color and the employment of this principle can be applied to many operations making simple what might otherwise require considerable skill and experience.

On account of the connection of offices with factories some of the improvement in the lighting of the latter has extended to the former. Office work as a rule does not require as high intensity as factory work but requires more refinement in the form of diffusion. One of the important factors in the success of office lighting is the elimination of bright reflections from furniture and paper surfaces. This has been very successfully accomplished by the use of semi-indirect and indirect fixtures with matte surface ceilings. It has been found⁴ that the eye suffers less fatigue under indirect than under any other type of lighting. The dense bowl semi-indi-

rect unit gives practically the same illumination effect as the direct and the more dense the bowl is, the less eye fatigue is caused by it. Considerable improvement has been made in the design of semi-indirect bowls during the last few years. These are mainly in the way of dust proof units.

domes above the bowls for use where ceilings are not suitable for use as secondary light sources and others have clear glass tops. Other fixtures are equipped with automatic cleaning devices operated by the same pull-chain that operates the switch. Every time the lamp is lighted or extinguish-

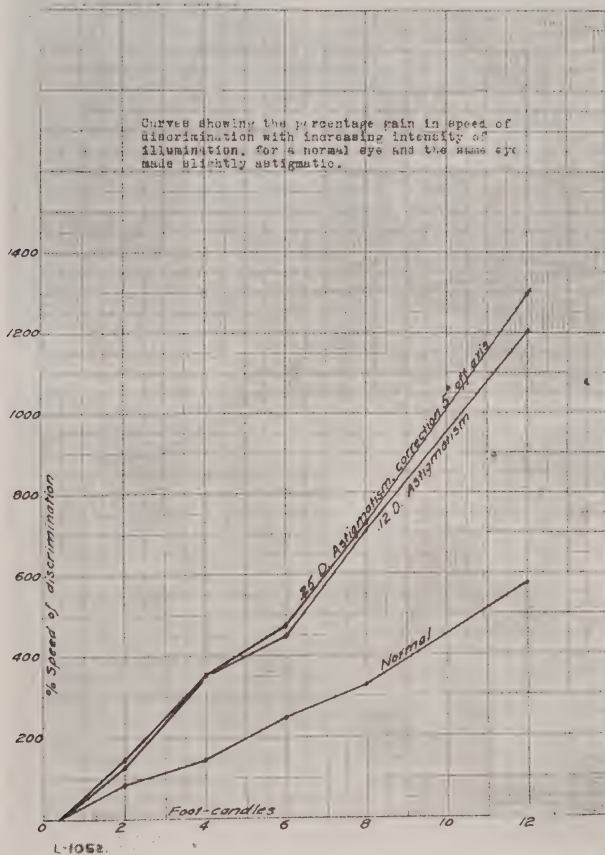


Figure 7

Totally enclosing units can now be obtained that have all the good qualities of the open inverted bowls with the dust proof feature of enclosing globes. Some of these have reflecting

ed a felt squeegee makes a complete revolution of the interior of the bowl removing all dust.

About 5 to 10 ft. C. might be considered as representative of good

office lighting at present although there are some installations of from 14 to 19 ft. C.

The period of transition from daylight to darkness when the fading daylight must be reinforced by artificial light has always been one of the difficult problems to solve. During this period the eye is attempting to work under two conflicting conditions. It is adapted to the color of daylight and the introduction of the yellower artificial light disturbs its condition of equilibrium, and comfortable vision is not obtained until artificial light dominates the situation and the eye becomes adapted to it. To reduce the annoyance of this period CE mazda lamps have been found very successful. The color of this light, nearly white, blends with the daylight and

work can be carried on with very little interference.

Store lighting has not been noticeably improved during the last few years in spite of the great turnover of retail merchandise merchants are making good use of the attractive value of light in their show windows but in the stores where the selling and buying is carried on the general level of intensities is low. In a recent survey⁵ of 25 of the large stores of the continent involving measurements of intensities at 163 sections it was found that at only 6 sections were the intensities 6 ft. C. or over and the general run of intensities ranged from 1 to 4 ft. C. Merchants have resorted to high intensities temporarily to induce increased sales in certain sections. Of course where light colored

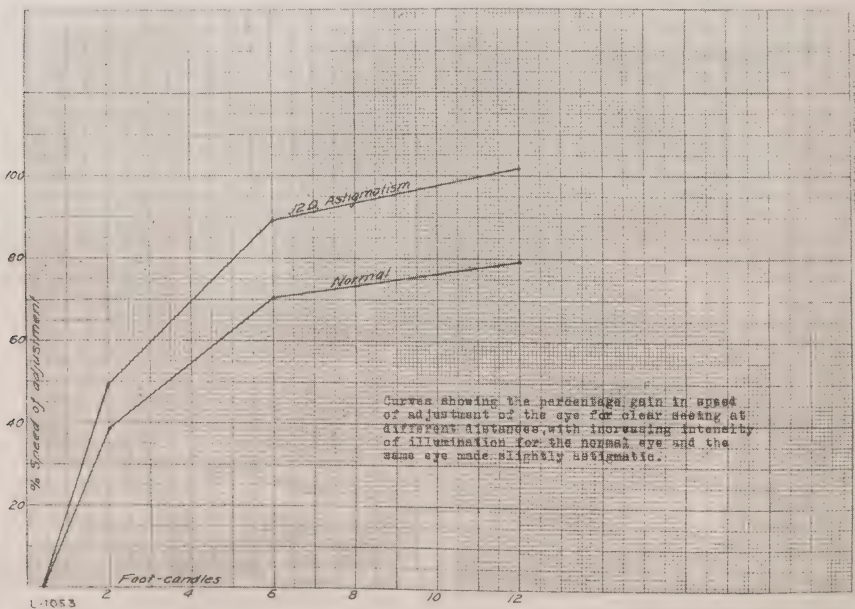


Figure 8

goods are shown lower intensity will be sufficient than if the goods are dark.

The use of artificial daylight in stores is increasing. It has been found that general illumination by C2 lamps can be produced at a reasonable cost and this blends well with daylight and produces more satisfactory results than the unmodified tungsten light. For color matching localized lighting of north skylight quality is supplied where needed.

In the foregoing only the monetary aspect of artificial lighting has been considered. The physiological aspect has been studied⁶ showing the effect of intensity of illumination on the working of the eye. This investigation was conducted over a range of intensities from 4 to 36 ft. C. for some of the functions and from .015 to 36 for others. It was found that with increasing intensity a gain was obtained in visual acuity, power to sustain acuity, speed of discrimination and speed of adjustment of the eye for clear vision at different distances Figs. 5, 6, 7 and 8. These gains were greater for eyes with slight uncorrected defects than for normal eyes and there are indications that the middle aged and aged eyes are benefitted more than young eyes. The increase in acuity is very rapid up to about 5 or

6 ft. C. after which it becomes more gradual. The other functions of the eye that are affected by time show a more gradual gain at lower values and more rapid at higher intensities. The power to sustain acuity of vision shows the greatest increase.

These functions of the eye all have a very direct bearing on the amount and quality of work that can be performed by an individual and the ease with which it can be done and a knowledge of their performance under varying intensities of illumination proves that increased production with increased intensity is based upon sound physiological facts and is the logical result. It also points the way for the conservation of the eyesight of the people and the elimination of the evils that have resulted in the past from prolonged use of poor lighting.

In view of the conditions under which high intensity lighting has been evolved, it is not surprising that the greatest improvement has been made in the industrial field. The value of high intensity has been firmly established from both the economic and hygienic viewpoints and there are strong indications that we are on the threshold of a new era of artificial lighting that will include all branches of industry and commerce.



HYDRO NEWS ITEMS

Niagara System

GENERAL—Requests for rates for Hydro power have been received from Port Dover, Thedford, Alvinston and Merlin and it is expected that power may be supplied to these municipalities during the present year.

NEWBURY—The Village of Newbury has recently signed a contract for power with the Hydro-Electric Power Commission, the necessary by-laws having been passed in the fall of 1920. The Commission has been requested to construct a distribution system in the village and this work will be proceeded with at an early date.

STAMFORD TOWNSHIP—The Commission is at the present time constructing a new sub-station for the Stamford Township Hydro-Electric System. The load on this system has rapidly increased and it is expected that a considerable amount of rural load will be handled from this station in the near future.

WALKERVILLE—Engineering assistance is being given to the Walkerville Hydro-Electric System in connection with a proposed new street lighting system

Eugenia System

GENERAL — The Bruce County transmission line extension to the Eugenia System, a description of which has already been given in THE BULLETIN, was placed in operation for the first time as far as Wingham on December 20th and as far as Kincardine on January 11th. The delivery of power over this extension adds approximately 64 miles of 22,000-volt circuit to the Eugenia System and is serving at the present time sub-stations at the H.E.P.C. Stone Quarry, Wingham, Teeswater, Lucknow and Ripley, all of which are in active service having been connected at various times since December 20, 1920. The Kincardine station will probably be completed and placed in service in the course of two or three weeks.

H.E.P.C. STONE QUARRY—Power was delivered for the first time to the H.E.P.C. Stone Quarry sub-station, near Walkerton, on February 3rd. This load will, in two or three months, approximate 500 horsepower and is fed off the Bruce County extension of the Eugenia System lines. The stone is being sold to the Hanover Cement Company in Hanover for use in manufacturing cement.

LUCKNOW—The distribution system in this municipality which has been constructed by the Commission, was placed in service for the first time on January 11th, receiving power at 4,000 volts from the sub-station at Holyrood, located approximately seven miles north of the town.

KINCARDINE—The construction of the distribution system in this municipality, as well as the sub-station, is progressing favorably and it is expected that both will be ready for receiving and delivering power some time during the month of March.

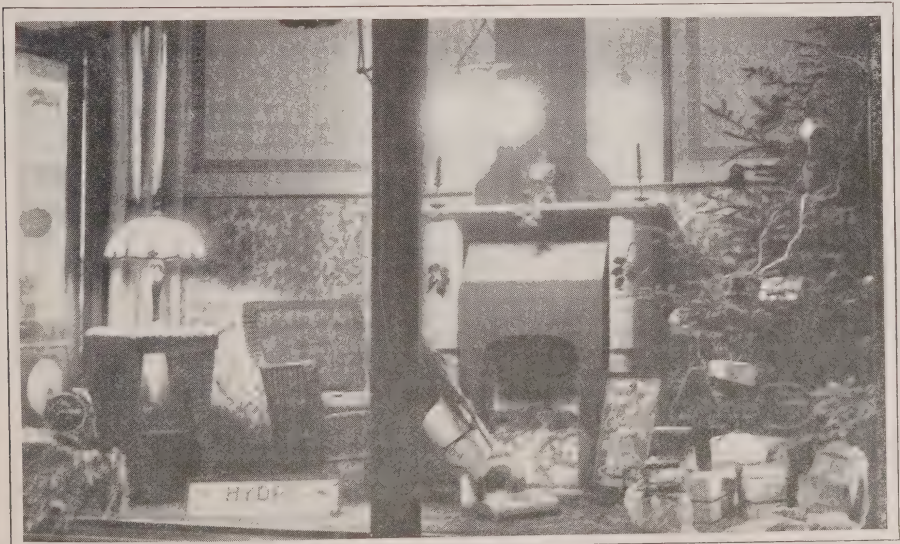
KINCARDINE TOWNSHIP—Estimates are being prepared covering service to the Police Village at Tiverton and the Hamlet of Bervie in Kincardine Township.

RIPLEY—Power was delivered to this municipality on January 12th, ser-

vice being received from the Holyrood sub-station located approximately seven miles east of the village. The service was delivered to a partially completed distribution system for the purpose of serving a power customer and the construction of the various lighting and street lighting circuits is progressing favorably and will probably be completed by about March 1st.

TEESWATER—The distribution system in this municipality which was being constructed by the Commission has now been completed and power was delivered to same for the first time on December 23rd, from a sub-station located at the village.

WINGHAM—Power was delivered to this municipality for the first time on December 20th from a sub-station located within the limits of the municipality. The distribution system in



The Belleville Hydro office makes a point of keeping the show window an active sales aid. This is a recent display.

the municipality is being reconstructed by the Commission, all efforts at the present time being confined on constructing additional primary circuits to serve new power customers which the old plant was incapable of taking care of.

Central Ontario System

BLOOMFIELD—Extensions to the street lighting system are contemplated and construction will be undertaken as soon as weather conditions permit.

HAVELOCK—The 4,000-volt line from Norwood Station and the Have-lock Local Distribution System were made alive on January 13th.

Negotiations are proceeding with the C.P.R. for the sale of power for their shops.

MARMORA—Following a breakdown in the local plant, service was given in Marmora December 14, 1920. The reconstruction of the local distribution system has been completed.

NORWOOD—The local distribution system lines at Norwood were made alive on January 12th.

WELLINGTON—A further issue of \$7,000 in 6½ per cent. debentures is proposed to finance the completion of the local system.

St. Lawrence System

GENERAL—A number of new municipalities are presenting to the Hydro question to the people during the municipal elections on the first of the

year. These include, Casselman, Finch, Avonmore, Aultsville, Newington, and St. Isadore de Prescott. Public meetings are arranged and Hydro representatives will explain the manner in which the undertaking is handled.

The Williamsburg sub-station is nearing completion, and will be placed in service before the end of the year.

Progress on the construction of lines in the Alexandria District is such that it is hoped service will be supplied to Alexandria some time in January.

A meeting was held recently at Apple Hill, at which officials of all the municipalities in this district were present to discuss the question of a central office and administering staff. It is proposed to operate the various municipalities in the district by one organization and staff suitably located.

ALEXANDRIA—Power was turned on at Alexandria on January 18th. An effort is being made to supply power to a number of industries in the municipality. A new street lighting system was installed, and greatly improves the municipality. A banquet was held on the evening of the day power was turned on, and a number of the Commission's representatives were present. The municipality is making final arrangements to take care of the management of the local system.

APPLE HILL—The station at Apple Hill, consisting of a 300 Kva. transformer, is practically complete, and the power will be turned on to supply the village as well as Maxville, in the course of a few days.

CORNWALL—Work is proceeding on the construction of lines to the Cornwall Pulp and Paper Company, a new industry locating in Cornwall. It is hoped that power will be supplied to this company in the course of a month. The company is contracting for 3,000 horsepower to be used for the manufacture of ground wood pulp.

The Toronto Paper Company Station has been increased, and has now a capacity of 1,500 Kva.

Thunder Bay System

PORT ARTHUR—The construction of the spur line, from Sprucewood on the main transmission line to Port Arthur, to the Village of Nipigon, is progressing favorably as is the substation of the Nipigon Fibre and Paper Mills Company, Ltd., at Nipigon Village for which this spur line is required. The company expects to begin operation in March manufacturing ground wood pulp, using about 3,000 horsepower and gradually increasing its demand to about 8,000 horsepower on the initial installation. The ultimate demand of this plant will vary from 10,000 to 20,000 horsepower, the transformer capacity of the present sub-station being 12,000 Kva.

Since power was first delivered to Port Arthur on December 20, 1920 from the Cameron Falls Development on the Nipigon River, the Commission has been able to supply the demands of the municipality without difficulty. Progress is being made on completing the second unit and it is expected that two complete units will be available

for supplying power to this system early in the month of March, the total capacity of which will be approximately 14,000 Kva. until the completion of the permanent dam in the fall of 1921 at which time the capacity of the two units will approximate 25,000 horsepower.

Rideau System

LANARK—The Village of Lanark has signed a considerable number of contracts with its citizens for power and light, and is preparing to undertake construction in the spring.

MERRICKVILLE — The Dominion Construction Company and Ramsay, owning a quarry east of Merrickville, has been forwarded a proposition for a supply of power. The company estimates that 400 horsepower will be required, and the proposition is now being considered by it.

KEMPTVILLE—Efforts are being made to obtain sufficient contracts in the Village of Kemptville, so that service may be extended to the municipality at an early date.

Maskakee Lake, Saskatchewan, is being developed for epsom salts, glauber salts, magnesium carbonate, and a fire occurs before he has corrected the difficulty, he is personally responsible for any damage to prop-sodium chloride and potassium salts. The evaporating plant will produce from 25 to 30 tons of salts every 24 hours.

Highest Railway Stations in Canada

The highest railway stations, with their elevations in feet above sea-level, in the respective provinces of Canada are as follows:

Province	Station	Feet
Nova Scotia.....	Folleigh	612
New Brunswick.....	Adams	1,204
Prince Edward Id.	North Wiltshire	311
Quebec.....	Boundary	1,850
Ontario.....	Dundalk	1,705
Manitoba.....	Erickson	2,053
Saskatchewan.....	Senate	3,171
Alberta.....	Mountain Park	5,820
British Columbia.....	Stephen	5,332
Yukon.....	Meadows	2,924

Fifty miles of drainage ditches have been constructed in the Sperling and Morris districts of Manitoba in 1920, at a cost of \$140,000. These ditches will bring much waste land under cultivation.

New coal deposits are to be developed on an island near Nanaimo, British Columbia.

The Catch of salmon, cod, lobsters, halibut, haddock and mackerel showed increases in 1919 over 1918, while herring, whitefish, trout, smelts and sardines showed decreases.

In the year ending Sept. 30, 1919, 249,626 apple trees, 50,662 pear, 46,880 plum, 32,535 peach, and 55,612 cherry trees were sold by nursery men in Canada.

From 510 salmon, taken in nets between June 2nd and August 5th, 2,800,000 eggs were secured and placed in hatchery at Tadoussac, Quebec.

WANTED

Several permanent positions open for experienced electrical station layout, designing draftsmen. Preference given technical graduates. Apply Employees' Relations Dept.

HYDRO-ELECTRIC POWER COMMISSION
OF ONTARIO

190 University Avenue, Toronto

HYDRO MUNICIPALITIES

NIAGARA SYSTEM

Acton	1,563
Ailsa Craig	447
Ancaster	400
Ancaster Twp.	4,621
Aylmer	2,177
Ayr	809
Baden	710
Barton Twp.	8,029
Beachville	503
Biddulph Twp.	1,763
Blenheim	1,533
Bolton	675
Bothwell	700
Brampton	4,238
Brantford	28,725
Brantford Twp.	8,061
Breslau	500
Brigden	400
Burford	700
Burford Twp.	3,845
Burgessville	300
Caledonia	1,150
Chatham	15,030
Chippawa	1,095
Clinton	1,948
Comber	800
Copetown	230
Dashwood	350
Delaware	350
Dereham Twp.	3,233
Dorchester	400
Dorchester S. Twp.	1,339
Drayton	622
Dresden	1,413
Drumbo	375
Dublin	213
Dundas	5,078
Dunnville	3,402
Dutton	858
Elmira	2,238
Elora	1,122
Embro	481
Etobicoke Twp.	6,586
Exeter	1,431
Fergus	1,609
Flamborough E. Twp.	2,443
Forest	1,418
Galt	12,558
Georgetown	2,010
Glencoe	865
Goderich	4,592
Graham Twp.	3,242
Granton	300
Guelph	16,974
Hagersville	1,058
Hamilton	110,137
Harriston	1,381
Hensall	715
Hespeler	2,929
Highgate	379
Ingersoll	5,278
Kitchener	19,767
Lambeth	350
Listowel	2,437
London	58,421
London Twp.	5,744
Louth Twp.	2,214
Lucan	640
Lynden	622
Markham	813
Merrittton	2,358
Milton	1,750
Milverson	929
Mimico	2,490
Mitchell	1,672
Moorefield	335
Mount Brydges	500
New Hamburg	1,356
New Toronto	2,551
Niagara Falls	12,434
Niagara-on-the-Lake	2,014
Norwich	1,262
Norwich N. Twp.	2,011
Norwich S. Twp.	1,814
Oil Springs	548
Otterville	400
Palmertson	1,815
Paris	4,886
Parkhill	1,202
Petrolia	2,954
Plattsville	500
Point Edward	984
Port Colborne	2,987
Port Credit	1,100
Port Dalhousie	1,391
Port Stanley	732
Preston	4,966
Princeton	800
Ridgetown	2,180
Rockwood	520
Rodney	656

Sandwich	3,443
Sarnia	12,178
Scarborough Twp.	6,566
Seaford	2,027
Simcoe	3,818
Springfield	426
St. Catharines	19,189
St. George	600
St. Jacobs	400
St. Mary's	3,807
St. Thomas	17,209
Stamford Twp.	3,702
Stratford	17,143
Strathroy	2,687
Streetsville	475
Tavistock	917
Thamesford	388
Thamesville	808
Thorndale	250
Tilbury	1,623
Tillsonburg	2,788
Toronto	489,681
Toronto Twp.	3,291
Townsend Twp.	3,291
Vaughan Twp.	4,090
Walkerville	5,914
Wallaceburg	3,922
Waterdown	790
Waterford	985
Waterloo	5,105
Waterloo Twp.	6,273
Watford	1,133
Welland	9,876
West Lorne	700
Wellesley	583
Weston	2,495
Windsor	29,344
Woodbridge	600
Woodstock	10,051
Wyoming	495
York Twp.	37,722
Zurich	457

Total 1,122,472

SEVERN SYSTEM

Alliston	1,224
Barrie	6,775
Bee'son	492
Bradford	866
Camp Borden
Coldwater	584
Collingwood	7,849
Cookstown	635
Creemore	615
Elmvale	690
Midland	7,339
Orillia	8,058
Penetang	3,664
Port McNichol	564
Stayner	870
Thornton	200
Tottenham	475
Victoria Harbor	1,496
Waukegan	600

Total 42,906

WASDELL'S SYSTEM

Beaverton	932
Brechin	225
Brock Twp.	2,871
Cannington	818
Eldon Twp.	2,085
Gamebridge	70
Kirkfield	128
Mara Twp.	2,486
Sunderland	570
Thorah Twp.	1,116
Woodville	400

Total 11,711

NIPISSING SYSTEM

Callander	650
Nipissing	100
North Bay	9,413
Powassan	519

Total 10,682

MUSKOKA SYSTEM

Gravenhurst	1,502
Huntsville	2,113

Total 10,682

EUGENIA SYSTEM

Alton	450
Artesia Twp.	2,392
Arthur	1,027
Chatsworth	257
Chesley	1,703
Deby Twp.	1,577
Dundalk	700
Durham	1,500

Elmwood	350
Flesherton	378
Grand Valley	558
Hanover	3,225
Holstein	285
Horning's Mills	350
Kilsyth
Kincardine	2,139
Lucknow	907
Markdale	925
Mount Forest	1,716
Neustadt	412
Orangeville	2,173
Owen Sound	11,768
Priceville
Ripley
Shelburne	970
Tara	520
Teeswater	824
Wingham	2,358

Total 33,236

OTTAWA SYSTEM

Ottawa	104,007
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THUNDER BAY SYSTEM

Port Arthur	15,100
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CENTRAL ONTARIO SYSTEM

Belleville	12,345
Bloomfield	500
Bowmanville	2,853
Brighton	1,387
Camden Twp.	2,061
Cobourg	4,835
Colborne	939
Darlington Twp.	3,446
Deloro	347
Deseronto	2,117
Havelock	1,356
Kingston	23,737
Lakefield	1,195
Lindsay	7,880
Madoc	1,146
Marmora	858
Millbrook	746
Napanee	2,864
Newburgh	426
Newcastle	552
Norwood	652
Omenee	467
Orono	700
Oshawa	9,748
Peterborough	20,904
Pickering Twp.	4,205
Pictou	3,257
Port Hope	4,311
Richmond Twp.	1,948
Seymour Twp.	2,499
Stirling	823
Trenton	6,107
Tweed	1,292
Wellington	802
Whitby	3,471
Whitby Twp.	1,649
Whitby East Twp.	3,168

Total 118,617

ST. LAWRENCE SYSTEM

Alexandria	2,220
Apple Hill
Brockville	9,418
Chesterville	925
Lancaster	574
Martintown
Maxville	687
Prescott	2,660
Williamsburg	200
Winchester	1,047
Winchester Springs

Total 16,470

RIDEAU SYSTEM

Carleton Place	3,844
Kemptville	1,127
Lanark	511
Perth	3,545
Smith's Falls	6,356

Total 13,745

ESSEX COUNTY SYSTEM

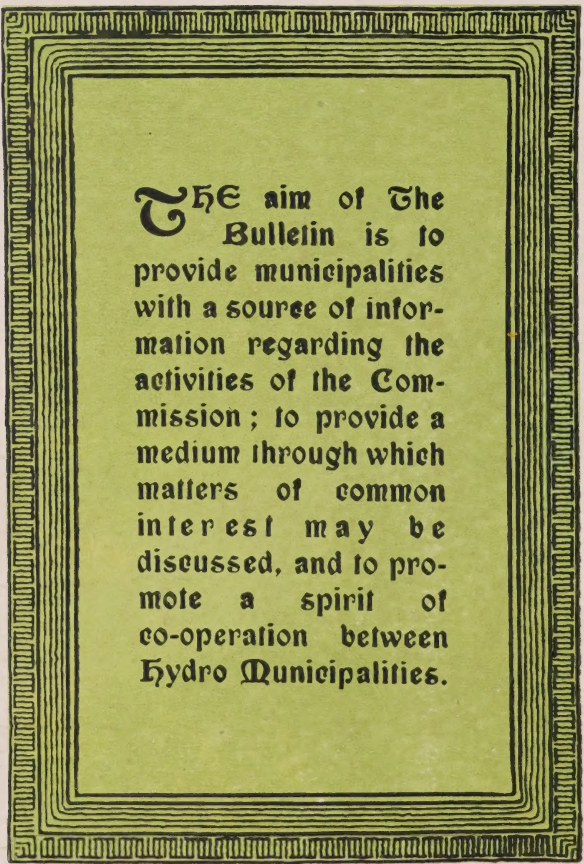
Amherstburg	2,386
Canard River	50
Cottam	333
Essex	1,753
Harrow	619
Kingsville	1,567
Leamington	3,907

Total 10,615

THOROLD SYSTEM

Thorold	4,325
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Frequencies: Niagara, Thorold and Essex County Systems—25 cycles; all other Systems—60 cycles.



THE aim of The
Bulletin is to
provide municipalities
with a source of infor-
mation regarding the
activities of the Com-
mission ; to provide a
medium through which
matters of common
interest may be
discussed, and to pro-
mote a spirit of
co-operation between
Hydro Municipalities.